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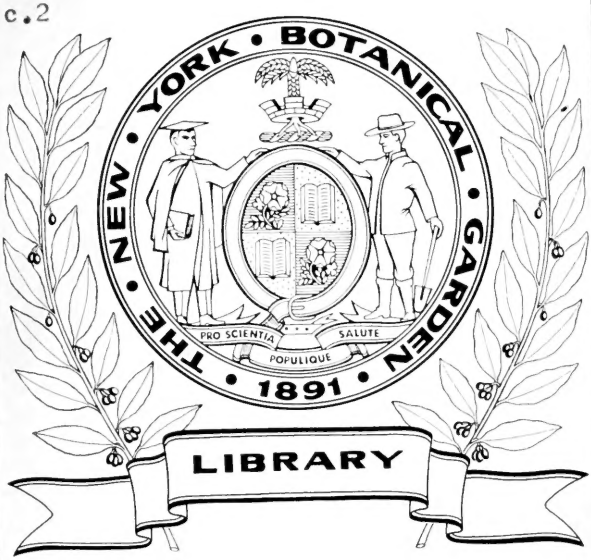
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Juncus

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REVISION

OF THE

NORTH AMERICAN SPECIES OF THE GENUS

JUNCUS,

BY

GEORGE ENGELMANN, M.D.

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that mean elevation, and in August it is about equal to it. The mean lowest stage takes place in December, and is not quite six feet high; its greatest average volume of water is reached in May, with more than twenty feet. The mean annual stage in these seven years ranged from 7.7 feet in 1864 to 16.8 feet in 1844, and the mean monthly stage from 2.2 feet in December, 1863, to 33.2 feet in June, 1844.

It was thought best to add a second table, giving the extremes of every month and every year in those seven years, as the extremes are of more practical importance for the boatmen, as well as the inhabitants of the banks, than the means. The table shows that from September to February the river has never been higher than 17 feet, from March to July never lower than 6 feet, and in April, May, and June never lower than 8 feet above low water mark. The lowest stage, zero, was observed on December 21, 1863, and the highest, 41.4 feet, on July 27, 1844.

In the subjoined table are given all the high water guages and the dates of their occurrence which I could find. They are partly taken from the above mentioned work of Humphreys and Abbott, partly from Mr. Homer's tables, and those between the years 1838 and 1858 have been observed by myself or by Mr. A. Kayser, when City Engineer. They have all been reduced to the standard adopted at present, the low water mark of December, 1863.

High water	1785,	April,	ab't 42.0 ft.	High water	1852,	May 20,	28.0 ft.
" "	1828,	March, (?)	36.3 "	" "	1853,	May 7,	30.0 "
" "	1838,	May 8,	27.0 "	" "	1854,	June 29,	
" "	1839,	May 28,	27.5 "	" "	1856,	May 9,	27.5 "
" "	1843,	May 2,	27.3 "	" "	1858,	June 14,	37.0 "
" "	1844,	June 27,	41.4 "	" "	1861,	May 15,	25.4 "
" "	1845,	June 27,	32.5 "	" "	1862,	April 26,	31.4 "
" "	1846,	May 10,	25.0 "	" "	1863,	March 4,	18.0 "
" "	1849,	March 10,	27.5 "	" "	1364,	May 14,	24.4 "
" "	1851,	June 10,	37.0 "	" "	1865,	July 28,	26.8 "

In this list, embracing twenty years, the highest rise took place in March three times, in April twice, in May nine times, in June five times, and once (last year) in July; but all the greater floods, with the exception of that of 1785, took place in June.

One word more about the rain curve on the diagram. This curve was, in all those four years, much less regular than it usually is with us. While, commonly, the greatest quantity of rain descends in May and June, the rains of those months in all those four years, and especially in the last three, were unusually light, and sometimes even the lightest of all the twelve months of the year. The meteorological table for the year 1865 (p. 419) shows that we have returned to a period of greater regularity and heavier summer rains.

E5
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A Revision of the North American Species of the Genus JUNCUS, *with a Description of new or imperfectly known Species.* By GEORGE ENGELMANN, M.D.

The difficulty I found in arranging the species of *Juncus* of my own herbarium, the doubts in which the authors left me by incomplete and unsatisfactory descriptions and by confusion in the names and synonyms, the want of confidence which all my correspondents, even such as had paid a good deal of close attention to it, seemed to place in themselves and their own judgment when this genus was under discussion—all this induced me to enter upon a critical study of our *Junci*. I was greatly aided by the most liberal contribution of specimens and of observations from all sides; among those to whom I am thus indebted I mention Prof. Asa Gray, of Cambridge, and Messrs. E. Durand, C. E. Smith, and Prof. Leidy, of Philadelphia, who sent me their own and the herbaria of the institutions under their care; Dr. J. W. Robbins, of Massachusetts; Rev. O. Brunet, of Quebec; Dr. H. P. Sartwell, of New York; Prof. T. C. Porter, of Pennsylvania; Mr. M. S. Bebb, of Washington; Rev. M. A. Curtis, of North Carolina; Mr. W. H. Ravenel, of South Carolina; Dr. A. W. Chapman, of Florida; Mr. E. Hall, of Illinois; and last, but not least, Prof. W. H. Brewer, of the Calafornia State Survey, and my indefatigable and ever obliging friend, Mr. H. N. Bolander, of San Francisco. In Europe I was greatly assisted by Prof. Caspary, of Kœnigsberg, who compared E. Meyer's herbarium, and by Prof. A. Braun and Dr. Garcke, of Berlin, who examined Willdenow's and Kunth's herbaria for me. My very particular thanks are due to all of them. Michaux's and Lamarck's plants have, thus far, been inaccessible to me, and thus some questions of synonymy must remain unsettled for the present.

A very conscientious examination of over a thousand specimens from all parts of the country, with careful dissections of their flowers and fruits, and drawing of these details, has enabled me, I believe, to place the proper value on the characters derived from the different organs of these plants, and to arrive at definite conclusions in regard to their species and varieties and their affinities among themselves.

These investigations, to be sure, were all made "in the closet" since the end of last summer, but I trust that they are not the less reliable, and that those who have the opportunity will follow them up in the field, and will enable me not only to improve upon this paper, but also to publish, with their aid—which some have already promised me—an *Herbarium Juncorum Boreali-Americanorum normale*, which

will stand in place of expensive plates, and will, it is believed, be far preferable to them.

Arrangement.—The numerous species of the Genus *Juncus** have been divided into sections according to characters taken from their organs of vegetation, their stems and leaves and also their inflorescence, more than from the differences found in their flowers or fruits. In these most essential parts all the species show a remarkable uniformity, which will only permit us to make use of them to characterize minor divisions, and for specific diagnosis. Desvaux (Journ. Bot., Vol. I., Paris, 1808) had already separated our *Juncus repens*, on account of a peculiarity in the dehiscence of the capsule, and some alpine species, because of their long-tailed seeds, as two distinct genera, *Cephaloxys* and *Marsippospermum*. But we know now that other species of far different alliance form a transition from the ordinary loculicidal to the septifragal dehiscence, and that species of all forms and sections, and otherwise very dissimilar among themselves, have tailed seeds, and that others exhibit all the transitions from the tailed and loosely tunicated to the merely pointed and closely coated seed. From the following it will appear that these genera cannot stand even as sections.

Vegetative Organs.—The different forms of the rootstalks, and of the stems and leaves of these plants, are so well known that I need not here dwell upon them; by their differences the principal types of *Junci* are best characterized; those that produce no leaves or leaves equal to the stem itself, those that have channelled or flattened leaves, and those that bear knotted leaves. But I must say that we have forms that seem to bridge over these apparently well marked distinctions, and which again prove that nature knows nothing of our systematic subtleties, and that our systems are only an imperfect aid for our limited comprehension. To give an example —no section of *Juncus* seemed to be better characterized and more natural than that of the true *Junci* with naked stems and so-called lateral inflorescence. To this section we are bound to refer *J. Drummondi* and J. *Hallii*, while *J. biglumis*, which can scarcely be separated from them, is, in all our systematic works, far removed from them. Again, *J. Vaseyi* comes so close to *J. Hallii* that we would hesitate whether to class it with this or with the similar looking but flat-leaved *J. tenuis*, if *J. Greenii* did not unite it more directly with the latter one.

The form of leaves is not quite constant. While those of the articulate *Junci* are usually described as terete or compressed-terete, the observations of our southern botanists prove

* Steudel, in his Plantæ Glumaceæ, 1855, enumerates 196 species, many of them, however, undoubtedly nominal ones.

that in some species, at least, soil and moisture have a most important influence on them, as they also have on the development of the inflorescence; the overgrown forms of *J. scirpoides*, as I understand that species, have large, laterally compressed, gladiate leaves, while in the forms grown on drier and poorer soil the leaves become almost or entirely terete. On the other hand, the peculiar tribe of articulate *Junci* of the Pacific slope, which I have called *Ensifolii* from their characteristic sword-shaped leaves, exhibits, in alpine situations, such narrow leaves that they might inadvertently be mistaken for terete ones.

Inflorescence.—The inflorescence offers us important but, to a surprisingly great extent, variable characters. All *Junci* have, as is well known, a terminal inflorescence, even where it is seemingly lateral. In the Californian sub-genus *Juncellus*, and in a few South American and antarctic species which form the sub-genus *Rostkovia* (gen. *Rostkovia*, Hook. f., *Rostkovia*, Desv., and *Marsippospermum*, Desv., in part), a single flower terminates the stem or scape; but all the true *Junci* have a more or less compound inflorescence of single flowers or of flowers crowded into larger or smaller heads.

In the inflorescence we observe numerous bracts, usually of a membranaceous texture; the uppermost bracts bear in their axils the flowers, which are always lateral, though in the species with single flowers they appear terminal. In these the lower of the two highest bracts, which are always found at the base of the flower and which were therefore termed "calyx" by Rostkovius, bears the flower in its axil, the upper one remaining sterile; but the trace of an axillary product, an abortive flower or a leaf-bud, ought occasionally to be found, as is regularly the case in *J. pelocarpus*. In the single flowered forms of this species the uppermost bract usually bears an abortive bud, or this bud grows out into a leafy branch, or it becomes a second flower; and then a third bract is formed, often again with a leaf-bud, but never, so far as I know, with a third flower. Thus we have the complete transition from the single flowered to the species in which the flowers are grouped into heads. In these each bract bears in its axil a flower in centripetal succession, the uppermost minute bracts remaining sterile in the center of the head.

The single flowered *Junci* bear panicles, or, as E. Meyer and many botanists after him called them, *anthelæ*, of different form and development. In some species (*e. g.* in the common forms of *J. tenuis* and *J. dichotomus*) the panicle has often the shape of an almost regularly dichotomous cyme, or at least the main branches are dichotomously divided; in most other species this regularity is considerably obscured by the development of many elongated branches from a short

axis, which often almost seem to constitute an umbel, but which are mostly of very different length, the lowest ones being by far the longest. These rays or branches often repeat the development of the main axis several times, or are regularly dichotomously divided, or they assume the appearance of one-sided spikes with lateral inflorescence, somewhat after the fashion of the *Borragineæ*. A remarkable example of this is furnished by *J. tenuis*, var. *secundus*, which form also proves that this uni-lateral development of the inflorescence can by no means constitute specific distinction, as a series of intermediate forms are not wanting. We observe a similar condition in *J. Balticus* and the var. *Pacificus;* the eastern form has the ordinary panicle, while that of the Pacific coast bears on the branches uni-lateral flowers.

In many others, and especially in all those that have knotted leaves, the flowers are arranged in heads. These heads consist of few, or are (often in *J. pelocarpus*) reduced to single, flowers, or they bear a great many, and the different forms of the same species often vary immensely in this respect. Thus we find from 2 or 3 to 50 flowers in each head of the different forms of *J. pallescens*, 6 or 9 to 100 in the forms of *J. nodosus*, and 2 or 3 to 80 or 90 in *J. Canadensis*. These heads are single, or composed of several heads crowded together, when they appear lobed. I have seen the axis of the heads abnormally elongated, thus changing them into spikes 9–12 lines in length in three different species, all found in the southern States. In all of them the lower flowers seem to remain sterile, and only the uppermost ones bear fruit; or, after the earliest flowers have performed their functions, the axis, perhaps in a wet season, continues to grow and produces a second crop of flowers. *J. cylindricus*, Curtis, is such a spicate form of *J. marginatus;* I have also seen it in *J. pallescens*, var. *fraternus*, and most beautifully developed in *J. Canadensis*, var. *longicaudatus*. In this last specimen numerous rays form a rather compact almost level-topped umbel, and each ray bears a head of 3 to 5 or 6 sessile, diverging spikes. The heads are either single, terminating the stem like the head of an *Allium*, or they form a more or less compound inflorescence similar to that of the single flowers.

Flowers.—The flowers of these plants consist normally of 5 circles, each of 3 component parts; 3 outer and 3 inner perigonial leaves, which we call, on account of their herbaceous texture, sepals; 3 outer and 3 inner stamens and 3 carpellary leaves; each of the circles alternating with the next one, so that the 6 stamens stand before the 6 sepals, and the 3 carpels before the 3 outer sepals; but the 3 stigmas, as well as the valves of the capsule, before the 3 inner sepals. The third circle, consisting of the 3 inner stamens, is sometimes wanting. Only in one instance, in the only species of

the sub-genus *Juncellus*, I find each circle consisting of two parts only, a curious and rare arrangement in a monocotyledonous plant.

In place of flowers we find, in some species with articulate leaves, leafy buds or shoots as the result of retrograde metamorphosis, or as the morbid product of the oviposition of the *Livia Juncorum* or some allied insect. They are most common in *J. pelocarpus*, which, from this peculiarity, has been named *viviparus* and *abortivus;* in *J. pallescens*, var. *fraternus*, which therefore got the name *J. paradoxus*, and in *J. nodosus genuinus.*

Sepals.—The always persistent sepals furnish important characteristics. The exterior and interior ones are sometimes similar but more frequently dissimilar; the former usually carinate or naviculate, more herbaceous, more strongly ribbed and sharper pointed; the latter more delicate, with a wider membranaceous margin, flat or slightly concave but not naviculate, and more frequently obtuse or only mucronate, but more variable in their outline than the exterior ones. Both sets of sepals are either equal in length or one exceeds the other, but neither their proportion nor the form of the inner sepals offer perfectly reliable characters in all species; in some they are more constant, while in others they vary considerably. In examining dried, and even living, specimens, the error of mistaking an involute sepal for an acute one must be avoided, an error into which even careful botanists have sometimes fallen. The nerves of the sepals, which are of such diagnostic importance in *Gramineæ* and even *Cyperaceæ*, are of minor value in *Junci*, as they vary considerably in different forms of the same species.

Stamens.—E. Meyer had already paid attention to the number of stamens and their proportion, and in many species valuable characters are derived from them, but they alone cannot constitute specific distinction. They are generally persistent, which permits us to examine them in all stages of development of the flower and fruit; only in *J. Smithii* and in *J. Rœmerianus* the anthers fall away early and the filaments only persist. The number of stamens is normally six, but in many, principally American, species, it is, by suppression of the inner circle, reduced to three; those three stamens stand, therefore, before the outer sepals and at the angles of the ovary or capsule. We have only two species in which their number regularly varies between three and six, *J. Buckleyi* and *J. caudatus;* in them the inner circle of stamens is incompletely present. In many tri-androus species we find occasionally a fourth or fifth stamen, and that often smaller than the rest; but where both circles are regularly developed I have never seen them unequal in size or shape, which we notice so often in other allied families.

The proportion of stamens and sepals, and of anthers and filaments, is often very constant, but in some species they vary very much, as may be seen in *J. scirpoides*, the different forms of which bear stamens of different length and anthers of different size without exhibiting other characters of sufficient specific value.

In a rare form of *J. Rœmerianus* I find both circles of stamens suppressed or rather undeveloped and in a rudimentary state, so that those plants become uni-sexual. Corresponding male plants may perhaps yet be discovered.

Filaments are always present; in some species they are very short, in others elongated, in all dilated at base, and, at least in the hexandrous ones, more or less united. Their base, which in the young flower adheres to the base of the pistil, after fecundation remains attached to the base of the sepals.

The shape of the anthers is of slight importance; they are longer or shorter, linear or oblong, in some species pointed or cuspidate, in most others obtuse or emarginate, more or less sagittate at base, but these characters show little constancy.

Pistil.—The pistil exhibits great differences in its form and furnishes good and generally constant characters. The ovary is obtuse or acute, gradually or abruptly elongated into the style; this organ is often very short but in many species it has the length of the ovary, or even exceeds it; in a few species only it is variable, *e. g.* in *J. scirpoides*, which in this as in most other organs offers a degree of variability scarcely seen in any other species. The stigmas are longer or shorter than the ovary with the style, always (except in *Juncellus*) three in number, very slender and more or less twisted; in *J. acutus* they are short and thick, and in *J. stygius*, as already Linnæus remarks, short and recurved. In just expanding flowers the length of the stamens is often equal to that of the ovary and style together, so that the stigmas only emerge from between the anthers, or they are equal to the ovary alone when the whole style with the stigmas protrudes over the anthers.

Capsule.—The capsule is diagnostically one of the most important organs in *Juncí*. It varies from globose to ovate, obovate, prismatic, pyramidal or subulate, terete or angular, retuse, obtuse or acute, mucronate or rostrate; it is shorter or longer than the sepals or equal to them; but all these characters vary within certain limits, in some species more than in others, and only the examination of a large number of specimens can decide about their constancy and value in a given species. The capsule is always three-valved (excepting again *Juncellus*), opening into the cells, the valves bearing on their median line the placentæ either immediately (parie-

tal placentæ and one-celled capsule) or on a fold which extends to the centre and forms the dissepiments (central placentæ and three-celled capsule); shorter dissepiments make semi-trilocular capsules. Very fragile dissepiments, which break off when the capsule opens, leaving the placentæ central and detached (septifragal dehiscence), are found in *J. repens* (therefore generically distinguished by Desvaux), and to some extent also in *J. Parryi*, *J. patens*, and *J. setaceus*. The placentæ of *J. Rœmerianus* are enormously developed into a spongy mass, which fills the greater part of the capsular cavity.

The capsule opens almost always from top to the middle or to the base; only in some of our species with subulate capsules (*J. scirpoides*, *J. nodosus*) the separation of the valves commences in the middle, while at the top they remain united for some time.

Seeds.—The seeds, when perfectly ripe, furnish some of the most interesting and constant characters, but they are so small and their markings so delicate that only a strong glass, or, better, a microscope with a magnifying power of fifty or sixty diameters, will properly exhibit them. It may not be useless to caution botanists not to be deceived by seeds loosely lying about with the specimens, as they very often will be found mixed.

The seeds are ascending or (the elongated ones) more or less erect, with a lower end at the insertion of the funiculus and an upper one at the chalaza, both ends united by the raphe and often by a distinct fold of the testa. The seeds are usually obovate or oblanceolate, thicker at the upper than at the lower end, mostly terete, or, in rare cases (*J. trifidus*), angular, when a few large seeds are pressed upon one another. The ends are sometimes obtuse (*J. bufonius*), but commonly either abruptly or more gradually pointed, apiculate or even fusiform (*J. pallescens*, *nodosus*, *scirpoides*). Very frequently the testa is slightly elongated beyond both ends of the body of the seed and forms a small, membranaceous appendage (*J. effusus*, *tenuis*, *marginatus*); in such seeds the longitudinal fold of the testa, mentioned above, also becomes more distinct. In many, and apparently more in American and in alpine or arctic, species (*J. Drummondii*, *Greenii*, *Canadensis*, etc.) these appendages become more conspicuous, and extend beyond the seed itself as empty, shrivelled, tail-like, white, or, rarely, reddish sacs. Such seeds have been called scobiform; their seed-coat is more loosely adhering and sometimes (*J. stygius*) can be readily removed. This elongation of the testa is of great diagnostic value, but the absolute or proportionate length of the appendages is extremely variable; even in the same capsule I find the lower seeds with shorter tails than the upper ones, and in *J. Canadensis* we see forms

with such different length of tail that only the absence of any other diagnostic characters can induce us to consider them as belonging to one and the same species. Much less can generic distinction be based upon this character, as was done by Desvaux, who comprised in his genus *Marsipposper-mum* all *Juncí* with tailed seeds. Even E. Meyer's (in Synopsis Juncorum, 1822, and in Ledebour's Flora Rossica, 1853) separation of the species with tailless seeds as a second section is unnatural, as not only tail-seeded kinds are found in all the great groups, but also species with intermediate seeds exist, which it would be difficult enough to place properly. R. Brown (Prod. Nov. Holl., p. 258) settles the whole question in the following pithy sentence: *Nec secernendæ sunt eæ quæ seminibus gaudent scobiformibus, testa silicit, quæ in pluri-bus utrinque laxa, in hisce valde elongata.*

The size of the seed varies from 0.1 to 2.0 lines in length, it mostly ranges between 0.2 and 0.3 lines, and rarely reaches 0.4 lines; the tailed seeds are usually larger than the others, averaging from 0.5 to 2.0 lines in length; even without the appendage, *J. trifidus* has the bodies of the seeds of 0.5, *J. castaneus* of 0.5–0.6, and *J. stygius* of 0.7–0.8 line in length.

The delicate markings of the seeds are so various, and in the same species so constant, that it will be useful to dwell a little longer on them. Their surface appears never quite, and rarely nearly, smooth, when magnified fifty or sixty times. We can almost always discover longitudinal ribs, more or less close together, from 8 or 12 to 30 or 40 or more around the seed; as it is difficult to count the ribs all around these small bodies, and as an approximate designation is quite sufficient, only the number visible on one side may be counted. These ribs are very marked, sharply elevated, in *J. marginatus* (*semina costata*), or they are reduced to more delicate lines in *J. Canadensis* and most tail-seeded species (*semina multico-stata* and *striato-costata*). These ribs or lines are usually united by very delicate transverse lines (*lineolæ*), when such seeds may be termed *costato-lineolata*, or by fewer, more prominent cross-bars, semina *costato-reticulata.*

When the ribs are fewer and wider apart, and united by transverse ridges so as to form somewhat rectangular meshes, I call the seeds *semina reticulata.* The area of these meshes is sometimes quite smooth (*J. militaris*), or crossed with very few transverse or longitudinal lines (*J. scirpoides*)—*semina areis lævibus reticulata*—or it is distinctly marked by numer-ous delicate transverse lines, sometimes, also, with one or two perpendicular lines: *semina areis lineolatis reticulata.* In very few instances I find an irregular and indistinct retic-ulation: *semina irregulariter sub-reticulata.*

A large number of *Juncí* exhibit a very delicate but regular transverse reticulation without (in fully ripe seeds) very

distinct ribs—*semina lineolata.* In some species the marks are coarser, in others more delicate.

We divide the seeds, then, into *semina reticulata, lineolata,* and *costata;* to both the former belong the tailless, to the latter the tailed seeds.

I arrange all the species, the seeds of which I have been able to study, according to their surface markings, in the following table. Our species are in italics, the foreign ones in Roman type:

I. SEMINA RETICULATA, vix seu distincte apiculata.,

1. Semina levissime irregulariter reticulata seu læviuscula, non costata nec lineolata. *Omnes e Juncorum genuinorum sectione.*
   J. Pacificus, compressus, filiformis, Smithii.
2. Semina regulariter reticulata, areis lævibus seu levissime longitudinaliter lineolatis. *Nostrates e Juncorum articulatorum sectione, pauci exotici graminifolii.*
   J. militaris, Elliottii, scirpoides, phæocephalus; J. Tasmanicus,* squarrosus capitatus.
3. Semina regulariter reticulata, areis tenuiter transverse lineolatis. *Omnes ad J. articulatos pertinent.*
   J. pelocarpus, articulatus, alpinus, pallescens, Bolanderi, brachycarpus, nodosus, xiphioides, Mertensianus; J. sylvaticus, atratus, obtusiflorus, rudis, oxycarpus, supinus, Leschenaultii.

II. SEMINA TRANSVERSE LINEOLATA, levissime costata ; vix seu distincte apiculata seu breviter caudata.

1. Semina areis latioribus fere transverse reticulata. *E Juncorum genuinorum et graminifoliorum sectionibus.*
   J. Balticus, setaceus, dichotomus.
2. Semina areis angustissimis transverse lineolata. *E Juncorum genuinorum et graminifoliorum sectionibus et Juncelli species unica.*
   J. effusus, patens, tenuis, Gerardi, bufonius, repens, saginoides; J. glaucus, pauciflorus, bulbosus.

III. SEMINA COSTATA, plus minus caudata.

1. Semina inter costas plerumque pauciores conspicuas lineolata; apiculata seu breviter caudata. *E Juncorum genuinorum et graminifoliorum sectionibus.*
   J. Rœmerianus, acutus, marginatus, longistylis, Buckleyi; J. maritimus.
2. Semina inter costas plures distincte reticulata ; apiculata seu plus minus caudata. *Ex omnibus Juncorum sectionibus.*
   J. arcticus, Drummondii, Hallii, biglumis, Greenii, Canadensis, var. *sub-caudatus.*
3. Semina inter costas numerosissimas tenues seu tenuissimas transverse lineolata seu lævia; caudata. *Ex omnibus Juncorum sectionibus.*
   J. Parryi, Vaseyi, triglumis, castaneus, stygius, trifidus, Canadensis, caudatus, asper; J. Jacquini.

It will be observed that in this arrangement some forms which I consider as belonging to one specific type had to be separated; thus, the Pacific form has been removed from *J. Balticus,* and the sub-caudate variety from *J. Canadensis,* proving that differences in the surface or in the shape of the seed alone are not sufficient to establish specific distinction.

* The Tasmanian *J. falcatus,* which I consider a distinct sepcies.

What constitutes a species.—The specific character lies not in any single organ of the plant, however essential it may be; only sufficient and corresponding differences in a series of organs can authorize us to recognize specific distinction. But as such discrimination is of course left to individual judgment, different investigators will arrive at different conclusions. Some species, to be sure, vary very little, and will, by every botanist, be recognized as distinct from all others, and as indivisible; such are, e. g., *J. filiformis*, *J. militaris*, *J. stygius*, *J. repens;* but other species exercise the botanists considerably, some forms being held distinct by some, while they are united by others; such are among our species, especially *J. pallescens*, *J. scirpoides*, *J. nodosus*, and *J. Canadensis*, all belonging to the group *Articulati*. I have no doubt that some botanists, especially such as have not the means of comparing the bewildering quantity of transition forms now before me, will find my views in this respect too contracted, but careful investigation in the field will, I trust, bear me out.

After these preliminary remarks I submit a list of our North American *Junci* and their principal varieties, as I understand them, followed by an account of their geographical distribution.

Systematic Arrangement.

GENUS JUNCUS, *Lin.*

Sub-Genus I. JUNCUS.

I. Junci genuini, caule aphyllo basi vaginis aphyllis seu rarius folia ipso cauli similia gerentibus stipato.

A. Glomeruliflori.

1. *J. acutus*, Lin., California, New Jersey. (?)
2. *J. Ræmerianus*, Scheele (J. maritimus, Auct. Am.), New Jersey to Texas.

} Maritimi

B. Singuliflori.

a. Pluriflori, panicula plus minus composita.

a. Robustiores, capsulis ovatis seu obovatis.

1. Foliiferi.

3. *J. compressus*, H. B. K., California, Mexico.

2. Aphylli.

* Hexandri.

4. *J. Breweri*, n. sp., California.
5. *J. Balticus*, Dethard.
   β. littoralis, coast of New England to the Mississippi.
   γ. montanus, Western deserts and Rocky Mountains.
   Sub-species *J. Pacificus*, Pacific coast.

} Communes.

** Triandri.

6. *J. procerus*, E. Mey.(?), California.
7. *J. effusus*, Lin., over the whole country.*

β. Graciliores, floribus plerumque paucioribus, sæpe viridulis, sepalis fructiferis sæpe patentibus, capsula subglobosa.

1. Aphylli.

8. *J. patens*, E. Mey., California.
9. *J. filiformis*, Lin., northward.

2. Foliiferi.

10. *J. Smithii*, n. sp., Pennsylvania.
11. *J. setaceus*, Rostk., Virginia to Louisiana.

Communes.

b. Pauciflori, panicula vix usquam composita.

a. Apiculati.

12. *J. arcticus*, Willd., Greenland.
Sub-sp. *J. Sitchensis*, north-western coast.

β. Caudati.

1. Aphylli.

13. *J. Drummondii*, E. Mey., Rocky Mountains and north-westward.

2. Foliiferi.

14. *J. Hallii*, n. sp., Colorado.
15. *J. Parryi*, n. sp., Rocky Mountains, and mountains of California and Oregon.

Arctici.

II. Junci graminifolii, caule nudo seu foliato; foliis planis seu semi-teretibus canaliculatis seu raro sub-teretibus.

A. Macrospermi, alpini, seminibus paucis magnis caudatis, foliis fistulosis.

a. Pauciflori.

16. *J. trifidus*, Lin., north-eastern mountains.
17. *J. biglumis*, Lin., Arctic regions.

b. Capitellati.

18. *J. triglumis*, Lin., Rocky Mountains to Arctic regions.
19. *J. stygius*, Lin., Western New York to Maine and New Brunswick.
20. *J. castaneus*, Smith, Rocky Mountains to Arctic regions.

Alpini.

B. Singuliflori.

a. Simplices, nudicaules, erecti.

a. Caudati.

21. *J. Vaseyi*, n. sp., Lake Michigan to Colorado.
22. *J. Greenii*, Oakes & Tuck., New England.

Tenues.

* The triandrous *J. Pylæi*, La Harpe, which is entirely unknown to me, seems to belong here or near *J. arcticus*.

β. Apiculati.

23. *J. tenuis*, Willd.
    a. communis, all over the country.
    β. secundus, Pennsylvania to New England.
    γ. congestus, California.
24. *J. dichotomus*, Ell., Dist. Columbia to Louisiana.
25. *J. Gerardi*, Lois., eastern sea and lake coasts, and salines.

b. Ramosi, caulophylli, diffusi.

26. *J. bufonius*, Lin., all over the country.

Tenues.

C. Glomeruliflori.

* Hexandri (No. 30, 3–6-andrus).

27. *J. repens*, Michx., Maryland to Louisiana.
28. *J. falcatus*, E. Mey., Pacific coast.
29. *J. longistylis*, Torr., Rocky Mountains and north-westward.
30. *J. Buckleyi* (J. filipendulus, Buckl.), Texas.

** Triandri.

31. *J. marginatus*, Rostk., Atlantic and central States to Texas.

Graminei.

III. Junci articulati, caule folioso; foliis septis transversis interceptis inde nodoso-articulatis.

A. Articulati veri, foliis teretibus seu leviter (in No. 40 var. forte) tereti-compressis.

a. Apiculati.

1. Sub-singuliflori.

32. *J. pelocarpus*, E. Mey. (J. Conradi, Tuck.), Newfoundland to South Carolina, and along the great Lakes.
    β. crassicaudex (J. abortivus, Chap.), Florida.
    γ (?). *subtilis*, Canada.

2. Pauciflori (No. 37, var. *δ*, ad multifloros accedens).

* Hexandri.

33. *J. articulatus*, Lin., Northern New York & New England.
34. *J. alpinus*, Vill. (J. pelocarpus, Gray), North-western New York to the Rocky Mountains and the Arctic regions.
35. *J. militaris*, Bigel., New England and southward.

** Triandri.

36. *J. Elliottii*, Chapm., N. Carolina to Florida & Alabama.
37. *J. pallescens*, Lam.
    a. diffusissimus, Texas.
    β. debilis (J. acuminatus, Mx.), middle and southern States east of the Mississippi.
    γ. robustus, Mississippi valley from Illinois to Louisiana.
    δ. fraternus (J. paradoxus, Mey.), Michigan and Massachusetts to the Rio Grande.

Articulati.

3. Multiflori.

* Triandri.

38. *J. brachycarpus*, n. sp., Mississippi valley and to the Rio Grande.
39. *J. Bolanderi*, n. sp., California.
40. *J. scirpoides*, Lam.
    a. macrostemon.
        A. *macrostylus*, South Carolina to Texas.
        B. *brachystylus*, New Jersey to Arkansas and Texas.
    β. brachystemon.
        A. *echinatus*, Maryland to Florida and Texas.
        B. *gladiatus*, North Carolina to Arkansas and Texas.

** Hexandri.

41. *J. nodosus*, Lin.
    a. genuinus, Pennsylvania to Canada and to the north-west coast.
    β. Texanus, Texas.
    γ. megacephalus, Western New York, south-westward to Texas and California.

Articulati.

b. Caudati.

* Hexandri (No. 43, 3–6-andrus).

42. *J. asper*, n. sp., New Jersey.
43. *J. caudatus*, Chapm., S. Carolina to Florida & Louisiana.

** Triandri.

44. *J. Canadensis*, Gay.
    a. brevicaudatus (J. acuminatus, Gray).
        A. *coarctatus*, Pennsylvania, northward and north-westward.
        B. *patulus*, Pennsylvania to Western New York & Ohio.
    β. subcaudatus, Connecticut to Georgia.
    γ. longicaudatus (J. paradoxus, Gray), Massachusetts southward to Louisiana, and north-westward to Minnesota.

Caudati.

B. Ensifolii, foliis iridaceis compressis equitantibus.

45. *J. Mertensianus*, Bong., Rocky Mountains north-westward to the coast.
46. *J. xiphioides*, E. Mey.
    a. auratus, California.
    β. littoralis, California.
    γ. montanus, Rocky Mountains and eastward into the plains.
    δ. macranthus, Oregon and to the north-west coast.
    ε. triandrus (J. ensifolius, Wick.), California to Unalaschka.
47. *J. oxymeris*, n. sp., California.
48. *J. phæocephalus*, n. sp., California.
49. *J. chlorocephalus*, n. sp., California.

Ensifolii.

Sub-Genus II. JUNCELLUS.

50. *J. saginoides*, n. sp., California.

Juncellus.

Geographical Distribution.

Of the fifty species above enumerated, thirty-three, or two-thirds, are peculiar to our country, and seventeen, or one-third, occur also in other parts of the world. Two of these seventeen (*J. effusus* and *bufonius*) are cosmopolitan species, which are found almost in all countries of our globe; six (*J. arcticus*, *trifidus*, *biglumis*, *triglumis*, *stygius*, and *castaneus*) are alpine or arctic forms, which also inhabit appropriate localities in the old world; three (*J. acutus*, *Balticus*, and *Gerardi*) grow principally near salt water, and also occur in Europe, and the former, also, in Africa and South America; three others (*J. filiformis*, *articulatus*, and *alpinus*) make their home in the northern parts of the northern hemisphere; one (*J. tenuis*) is also found in middle America and western Europe; and two extend southward over our limits, *J. compressus* into Mexico, and *J. procerus*, if our plant is correctly referred, to Chili.

The different forms of *J. Balticus*, *nodosus*, and *Canadensis*, grow in different regions. The eastern and northern *J. Balticus* is distinct from the form of the interior plains, and very much so from that of the Pacific coast; the Texan form of *J. nodosus* is very different from the northern one, and that of the western States and territories is quite unlike the others; *J. Canadensis* has a northern, an eastern, and a third form, which is more generally distributed.

None of the eight southern species are found anywhere else, and of the nine Pacific species only the two above mentioned extend beyond our territory to other parts of America, adding another proof of the well known fact, that of all our Floras that of the southern and that of the Pacific States are the most peculiar and exclusive ones.

From their geographical distribution our species may be arranged thus:

1. Over the whole country grow *J. effusus*, *tenuis*, *bufonius*, and *nodosus*. Of these only the last one does not extend into other Floras.

2. Over the whole country, with the exception of the western Plains and Mountains and the Pacific slope: *J. marginatus* and *pallescens*, both peculiarly North American.

3. Over the whole country with the exception of the great interior valley and the Pacific region: *J. pelocarpus* and *Canadensis;* both only found in North America.

4. In the great interior valley from Michigan to the Rio Grande: *J. brachycarpus*, and, with more extensive limits, one of the forms of *J. nodosus* (the var. *megacephalus*).

5. Northward—*J. filiformis* and the northern varieties of *J. nodosus* and *Canadensis;* north-eastward—*J. articulatus*,

Greenii, and, very locally, *J. Smithii;* north-westward, extending to the Rocky Mountains—*J. alpinus* and *Vaseyi*.

6. Southward, mostly south-eastward and to the Gulf, some of the species extending south-westwardly to Arkansas and Texas—*J. setaceus, dichotomus, repens, Elliottii, scirpoides, caudatus*, and *asper*, the latter only in the most north-eastern limits of the region; *J. scirpoides* as far north and south-west as any of these species; south-westward, *J. Buckleyi* and a form of *J. nodosus* (the var. *Texanus*).

7. On the Pacific slope, in the low country—*J. compressus, Brewerí, patens, arcticus* (var.), *Bolanderi*, and *oxymeris*. The following extend from the coast to the mountains: *J. Mertensianus, xiphioides*, and *phæocephalus*, the two former spreading eastward to and beyond the Rocky Mountains.

8. Maritime species, north-east—*J. Balticus, Gerardi*, and *militaris*, the two former extending inland along the lakes, the two latter also southward; south-east—*J. Rœmerianus;* Pacific coast—*J. acutus, procerus, Balticus*, sup-sp., and *falcatus*.

9. Alpine and arctic species; eastern—*J. arcticus, trifidus*, and *stygius;* western—*J. Drummondii, Hallii, Parryi, triglumis, castaneus, longistylis, chlorocephalus, saginoides;* the two last only on the Californian Alps. *J. biglumis* has been found thus far soley in the highest arctic regions of our continent.

The following table exhibits at a glance the geographical distribution of our species:

	Peculiar to our country.	Common with other countries.	Total.
1. Whole country	1	3	4
2. " " except Pacific region	2	..	2
3. " " " " " and Mississippi Valley	2	..	2
4. Interior valley	1	..	1
5. Northward	3	3	6
6. Southward	8	..	8
7. Pacific Slope	7	1	8
8. Maritime species	3	4	7
9. Alpine and Arctic species	6	6	12
Total	33	17	50

NOTES ON THE NORTH AMERICAN SPECIES OF JUNCUS.

1. J. ACUTUS, Lin., has been found by Prof. Brewer near San Luis Obispo, California, "where it is abundant in a stream in the hills between the town and the landing of the same name, a few miles from the sea, growing in dense tufts."

His specimens were collected in April in full bloom; the stem is nearly four feet high, the panicle six inches long; the flowers, absolutely identical with European specimens, are easily recognized by their broadly margined sepals, the inner ones being deeply emarginate, and by their thick and short subulate stigmas. I have also seen specimens said to have come from the coast of New Jersey; Baldwin collected it on the La Plata in South America, and Chamisso and Gaudichaud brought it from the same regions. *J. macrocarpus*, Nees, from the Cape of Good Hope is the same species.

2. J. Rœmerianus, Scheele, Linnæa, 22, 348; Walp. Ann. 3, 655: rhizomate longe repente; foliis caules (2–3 pedales) robustos rigidos teretes æquantibus; spatha paniculam supradecompositam patulo-effusam longe superante; glomerulis 3–5-floris; sepalis ovato-lanceolatis 5-nerviis exterioribus acutatis, interioribus brevioribus obtusis sæpe mucronatis; antheris six late linearibus filamento ter quaterve longioribus demum deciduis; stylo ovario ovato multo breviore; capsula ovata obtusa mucronulata sepala exteriora æquante placentis tumidis triloculari; seminibus late obovatis obtusis vix apiculatis tenuissime (sub lente) costato lineolatis (*J. maritimus*, auct. Amer.).

Atlantic coast of the United States from New Jersey to Florida and Texas.—Closely allied to the European *J. maritimus*, for which it has always been taken, until Scheele, without discovering its distinctive characters, gave it a new name. It is well marked by an open spreading panicle with slender, flexible branches, deciduous anthers; a very short style, which is not half as long as the obtuse ovary; an obtuse, short, deep brown capsule; remarkably large, spongy placentæ, which fill the greater space of the capsular cavity, and the like of which I have not seen in any other species; and obtuse, tailless seeds, marked with very slight, wavy ribs and slighter cross lines.—*J. maritimus* bears a rigid, fastigiate panicle, persistent anthers, an ovary attenuated into a style of nearly its own length, a greenish, acute capsule which usually exceeds the sepals, placentæ of ordinary size, and seeds with distinct tails and stronger ribs.

The light, brownish flowers are 1.5 lines, and the seeds 0.3 line, long, and nearly 0.2 line thick.

This is the only *Juncus* in which occasionally unisexual specimens occur (Georgia, Le Conte, in Hb. Acad. Philad., and Florida, Chapman, in Hb. A. Gray); these plants, pistillate by abortion of the stamens, have a stricter but fewer flowered panicle, and thus present a very unusual aspect; our southern botanists ought to find out under which conditions this form occurs, and whether any corresponding staminate plants grow with them.

3. J. COMPRESSUS, H. B. K. nov. gen. 1, 235; Kunth. En. 3, 317: rhizomate repente, caulibus (palmaribus sesquipedalibus) compressis farctis siccis tenuiter striatis; vaginis aphyllis muticis seu sæpius folia culmo simillima breviora gerentibus; spatha paniculam compositam seu decompositam ad ultimos ramos secundifloram æquante seu superante; sepalis lanceolatis, exterioribus acutis seu subulato-acutatis, interioribus paulo brevioribus obtusiusculis stamina six dimida seu tertia parte superantibus; antheris late linearibus filamento brevi multo (quadruplo quintuplo) longioribus; stigmatibus ovarium cum stylo fere æquilongo subæquantibus; capsula ovata acuta (inclusa?) triloculari; seminibus ovatis obtusis vix apiculatis læviusculis.

Salinas valley, in sandy river bottoms, May 1 in flower; Calif. State Survey No. 529, the only locality in our flora known to me. Dr. J. Gregg collected the same species in northern Mexico, smaller forms, eight inches high, with very short spathe, and a stouter one, 12–18 inches high, with longer spathe and larger panicle. The Californian specimens are 10–15 inches high, with a spathe 2–4 inches long; panicle small, rather simple, only the extreme branchlets with one-sided flowers; the reddish streaks on the sepals very pale; the only capsule seen (not ripe) was shorter than the sepals and contained a few large seeds, 0.37 line long and apparently very slightly lineolate.—This plant is evidently closely allied to *J. Balticus;* it bears very similar but paler flowers, with the same stout anthers on very short filaments; but the flattened stem and the frequent occurrence of leaves distinguish it. Among Fendler's Sante Fé plants, however, I find under No. 860, with the legitimate *J. Balticus*, var. *montanus*, small specimens 6–7 inches high, with the darker flowers of the former, but with a slightly compressed stem, and occasionally with a leaf from the vaginæ. Is that a form intermediate between and connecting both species?

4. J. BREWERI, n. sp.: rhizomate perpendiculari; caulibus cæspitosis (pedalibus) compressis lævibus farctis; vaginis nervosis muticis; spatha paniculam paucifloram in ultimis ramis secundam longe superante; sepalis subæqualibus ovatis late marginatis abrupte acuminatis; antheris late linearibus filamento brevi multo (quadruplo quintuplo) longioribus; stigmatibus ovarium cum stylo æqui-longo æquantibus exsertis; capsula . . . .

Wet, sandy soil, near Monterey, California, the same unfortunate locality that has so often been confounded by botanical writers with Monterey in Nuevo Leon, Real del Monte in Mexico, and even Montreal in Canada; Calif. State Survey No. 651, in flower in the latter part of May.—The perpendicular rhizoma (if a constant character) and the

strongly compressed stem, together with the broad and apruptly acuminate sepals, distinguish it from the smaller forms of *J. Balticus*, the absence of leaves and the form of the sepals from *J. compressus*, with both of which it is closely allied by the form of the stamens, so different from those of any other American or European *Juncus* of this section.—Stems a foot high, four or five inches of which belong to the spathe; inflorescence small, rather compact; flowers 2½ lines long; sepals dark brown, greenish in the middle, membranaceous on margin.—I have named this plant for Prof. Wm. H. Brewer in acknowledgment of his services in the cause of science in California.

5. J. Balticus, Dethard. ap. Willd., is well characterized by its long and large anthers, which it has in common only with the two last mentioned species, and its terete stem and leafless vaginæ. Originally found on the shores of the Baltic, it has been traced to those of north-western Europe and to our north-eastern coasts from Newfoundland to Massachusetts; but here it leaves its seaside home and appears in several swamps in Lancaster county in the interior of Pennsylvania; all along the great lakes it is a common plant, not unexpected, to be sure, as on their shores we meet with many other marine plants, such as *Cakile*, *Lathyrus maritimus*, *Euphorbia polygonifolia*, and others, while they are quite free from saline matter. Is it the ocean-like spray of the waves of these immense bodies of fresh water, is it the ever-varying sand formation of the downs, which invites sea-strand plants, or are they the remnants of an ocean-coast vegetation left from a period when the beds of these lakes were filled by an immense arm of the sea? Be that as it may, our species is not confined by the line of the lakes, but appears again on the upper Mississippi and St. Peters rivers, hence northwestward into the British possessions, and westward to the Mauvaises Terres and to the head waters of the Missouri, and then southward along the Rocky Mountains to Colorado and New Mexico, and farther west to the Cascade Mountains in Oregon. We find it again as a true maritime plant on the Pacific coast from the northern Russian islands to California and in Chili. This Pacific form is so different from the others that some will regard it as a distinct type. The different forms may be thus characterized:

J. Balticus genuinus: caulibus tenuioribus rigidis farctis; paniculæ laxioris ramis dichotomis; floribus minoribus; capsula obtusa mucronata, seminibus grosse lineolatis.

Var. *a. Europæus:* sepalis exterioribus acutioribus longioribus capsulam late ovatam obtusam mucronulatam subæquantibus; antheris minoribus filamento duplo longioribus;

seminibus ovatis obtusis brevissime apiculatis. — Northern Europe.

Var. β. *littoralis:* sepalis ut in Europæo capsulam angustiorem acutius angulatam longius mucronatam æquantibus; antheris majoribus filamento brevissimo quadruplo longioribus; seminibus ut in Europæo.—Atlantic coast to the upper Mississippi.

Var. γ. *montanus:* sepalis fere æquilongis æqualibus seu interioribus obtusioribus; antheris ut in littorali; capsula ovato-pyramidata angulata rostrata; seminibus minoribus angustioribus longius apiculatis.—Western plains and mountains.

Sub-sp. *J. Pacificus:* caulibus crassioribus mollioribus sæpe fistulosis; paniculæ densifloræ ramis secundis; floribus majoribus; sepalis exterioribus acutissimis interiora obtusa paulo superantibus capsulam ovatam acutam mucronatam subæquantibus; antheris majoribus filamento brevissimo quadruplo quintuplo longioribus; seminibus magnis ovatis obtusis. breviter seu vix apiculatis tenuissime irregulariter reticulatis seu lævisculis.—*J. Lesueurii*, Bolander in Proc. Ac. Calif. 2, 179; *J. Balticus*, Benth. Pl. Hartw. p. 341; *J. compressus*, E. Mey. Pl. Chamisso in Linn. 3, 368, planta Chilensis.—*J. Hœnkei*, E. Mey. Syn. Junc. p. 10, forma borealis pauciflora.

6. J. PROCERUS, E. Mey.? Linn. 3, 367; Kunth En. 3, 322: culmo erecto elato (tripedali) tereti striato farcto basi vaginis atrofuscis obtusis breviter aristatis stipato; spatha paniculam decompositam densifloram multiradiatam corymbiformem longe superante; sepalis æquilongis lanceolatis, exterioribus acutato-subulatis, interioribus obtusis mucronatis capsulam ovatam subacutam trilocularem æquantibus; staminibus 3 sepalis quarto parte brevioribus, antheris linearibus filamento paulo longioribus; seminibus majusculis ovatis.

In brackish marshes, San Francisco, Cal., *H. Bolander.*—In its technical character, especially in the form of the sepals and the capsule, this plant corresponds well with Meyer's Chilian species, but a specimen in the royal herbarium at Berlin, brought from Chili by D'Urville, has much smaller flowers, a more compound, loose-flowered panicle; smaller flowers, and smaller, narrow, long apiculate, finely lineolate seeds, and is in all respects similar to *J. effusus*, with the exception of the inner sepals and the capsule. But unwilling to give a new name to a plant so incompletely known, I provisionally refer this Californian to the Chilian species; I suggest, however, the possibility of the Californian plant being a hybrid between *J. effusus* and *J. Pacificus*, which both occur in its neighborhood; it seems that only very few and imperfect seeds can be found in the otherwise well developed specimens now

before me, and that in size and form these seeds, as well as the flowers, anthers and capsules, are intermediate between those of the supposed parents, while the number of stamens is that of *J. effusus*. The panicle is remarkably compact, and consists of 10–15 secondary branches of nearly equal length.

7. J. EFFUSUS, Lin., is found from Maine to the Rio Grande and to the Pacific, but is wanting in some districts. It has *always* three stamens, the small anthers of which are of nearly equal length with the filaments. The most prominent and very constant character consists in the number of stamens and in the obovate or even clavate, upwards almost tricoccous, *retuse* capsule; seeds apiculate and finely lineolate.

8. J. PATENS, E. Mey. Syn. Luzul. p. 28; Rel. Hænk. 1. 141; Kunth. En. 3, 318; *J. compressus*, E. Mey. Syn. Junc, p. 16, non H. B. K. This very distinct species seems not to have fallen under the observation of botanists since about seventy years ago Hænke discovered it near Monterey, Cal., until Mr. Bolander and Prof. Brewer again obtained it near San Francisco and in the Santa Lucia mountains of that State. Meyer's description in Rel. Hænk. l. c. is so complete that very little can be added. I find, however, the densely cespitose, slender, but wiry stems, not compressed but terete, and distinctly striate; they are 15 inches to 2½ and 3 feet high including the spathe, which has a length of 3 or 4 to 8 or 10 inches; their base is enclosed by elongated sheaths, brownish-red below and greenish straw-colored upwards, tipped with a conspicuous awn; the panicle, 1–2 inches long, consists of 3–5 larger branches, with the ultimate branchlets one-sided, spreading, or recurved, whence the specific name. The flowers are not quite as large as those of *J. Balticus*, and much lighter colored; sepals lanceolate, acute, exterior ones subulate at tip, equalling, or slightly exceeding, the inner ones, spreading in fruit; stamens about half the length of the sepals, and anthers nearly equal to the filaments; ovary with the short style about the length of the stigmas. The subglobose, mucronate capsule, a little shorter than the sepals, opens with septifragal dehiscence, the three placentæ with their membranaceous wings, remnants of the dissepiments, remaining in the center. The very numerous seeds are ovate, obtuse, usually oblique, obliquely apiculate, delicately lineolate, 0.22–0.30 lines long.

9. J. FILIFORMIS, Lin., which was formerly often taken for *J. setaceus* by American botanists, extends from Oneida lake in western New York to the White Mountains in New Hampshire, and to Maine, is common in Lower Canada and in the Hudson Bay region, and has also been found from the northern Rocky Mountains to the Cascade Mountains. The

American specimens are in nowise different from the European ones; the seeds are obovate, strongly apiculate, with a very distinct raphe, and are irregularly and rather indistinctly reticulated.

10. J. SMITHII, n. sp.: rhizomate? vaginis? foliis? caulibus bipedalibus teretibus farctis siccis striulatis; paniculæ laxæ subsimplicis pauciforæ spatha longissima; sepalis æquilongis, exterioribus acutatis, interioribus obtusis; staminibus 6; capsulæ exsertæ subglobosæ acutæ mucronatæ (fuscatæ) triloculares dissepimentis tenuissimis fragilibus; seminibus magnis obovato-oblongis obtusis vix apiculatis irregulariter reticulatis.

Pennsylvania, in a sphagnous swamp on Broad Mountain near Pottsvillle, Schuylkill county, where *Mr. Charles E. Smith*, of Philadelphia, for whom this species is named (*J. Smithii*, Kunth, is the English *J. tenuis*), discovered it in June, 1865, with nearly ripe fruit, and where he expects to obtain more complete specimens in the coming season, as it grows in a very accessible, but, thus far, little explored part of Pennsylvania. We will then learn whether I am correct in my surmise that it is a leaf-bearing species, closely allied to *J. setaceus*. The question may even arise, whether our plant is not the true *J. setaceus* of Rostkovius, as he credits it to Pennsylvania, and, so far as I know, the plant we take to be *setaceus* has not lately been found so far north. The figure of Rostkovius is too poor to decide the question, but his description is full enough to point to our *setaceus;* the "three-leaved calyx"—*i. e.*, the three bracts under the flower by which he distinguishes his species from *J. filiformis*—are found in most flowers of both *J. Smithii* and *J. setaceus*, and also in some other species, e. g., *J. tenuis*, but not in *J. filiformis;* the lowest of those three bracts generally bears an abortive bud in its axil, and has, therefore, another morphological value than the two upper ones.—The thin and wiry stems before me are two feet high, eight or nine inches of which belong to the spathe; the flowers are scarcely more than one line long, not much more than half as long as those of *J. setaceus;* the anthers had fallen off and only the six filaments remained; the thick but sharply angled and pointed capsule is light brown and shining; its valves seem to tear away from the dissepiments when it opens. The seeds are few and of large size, 0.4 line long, and irregularly ribbed and reticulated.—The small flower, the form of the sepals, the exsert, angular capsule, and the more elongated and differently marked seeds distinguish it abundantly from the next.

11. J. SETACEUS, Rostk. Mon. June. 13, t. 1, f. 2, is a regularly leaf-bearing species, though neither its author nor

most of the later writers make mention of the leaves, while E. Meyer (Syn. Junc. 1822, p. 18) already describes them, and Gray and Chapman are fully acquainted with them. Though its author credits the species to Pennsylvania, it is not now known to grow there; in all the herbaria examined by me I have seen no specimens found north of North Carolina, whence it extends as a common species to Florida and Louisiana.—It is well characterized by its terete leaves; a very long spathe; a compact or, sometimes, spreading, few-flowered panicle; smooth and shining sepals; a globose, scarcely angled, but conspicuously rostrate capsule, the dissepiments of which separate from the valves; and by the sub-globose, obtuse, coarsely lineolate or almost transversely reticulate seeds, with short appendages and distinct raphe, and seldom over 0.3 line long.

12. J. ARCTICUS, Willd. The only American specimens I have seen were brought from Greenland by Dr. Kane; they differ in no respect from the European plant. The seeds are 0.4 line long, obovate, oblique, obtuse, with very short appendages and distinct raphe; 12–16 ribs are visible on one side, with very faint cross lines.

Of the plant which is found on the Russian islands Kodiak and Sitcha, on the north-west coast of America, I have seen too few and too incomplete specimens to form a definite opinion. It seems to me to constitute a sub-species of *J. arcticus*, which might be designated as *Sitchensis*, and which can be distinguished by the much elongated spathe, the larger flowers, nearly equal sepals, turbinate pyriform capsules, with very few and apparently smaller seeds.

13. J. DRUMMONDII, E. Mey. in Ledeb. Flor. Ross. 4, 235: cæspitosus; caulibus (pedalibus sesquipedalibus) teretibus filiformibus; vaginis setaceo-aristatis; spatha paniculam simplicem (subtrifloram) plus minus superante; sepalis lanceolatis acutis vel exterioribus interiora vix superantibus acutatis stamina 6 plus quam duplo excedentibus; antheris linearibus filamento paulo longioribus; stigmatibus ovario gracili prismatico stylo perbrevi coronato brevioribus inclusis; capsula ovato-oblonga triangulari retusa triloculari sepala æquante seu eis breviore; seminibus ovatis striato-reticulatis longe caudatis.—*J. compressus, γ subtriflorus*, E. Mey. Linn. 3, 368, and Rel. Hænk. 1, 141; *J. arcticus*, Hook. Fl. Bor. Am. 2, 189; Gray, Pl. Hall & Harb. in Proc. Ac. Phil. 1863, p. 77.

Var. *β. humilis:* caulibus digitalibus; spatha brevissima 1–2-flora; sepalis obtusiusculis.

On the alpine heights of the Rocky Mountains of Colorado, *Hall & Harb.*, 563; to California, *Hillebrand;* the Cascade Mountains, *Lyall;* and to Unalaschka; the variety on Mount Shasta, Calif., at an altitude of 8,400 feet, *Brewer.*—The

soft, compressible stems are 8–17 inches high, and always, as far as I have seen, leafless; and when Meyer (Fl. Ross. l. c.) says that they occasionally bear leaves, he had probably one of the allied leaf-bearing species before him, which are, at first glance, so much like our plant that they have been almost constantly confounded with it. The spathe is ½–1½ inches long and usually exceeds the flowers; in the variety it measures only 2 or 3 lines and is shorter than the flowers, of which the primary one is sessile and the accessory one peduncled, just as we see it in *J. biglumis.* Flowers 3 lines or more long; sepals green on the back, brown on the sides, pale and membranaceous on the margins; outer ones with 5–7 nerves; stamens less than one-half, often only one-third as long as the sepals; capsule deep chestnut-brown and shining; seeds 0.3 line, or including the tails, about 1 line long; appendages as long as, or longer than, the body of the seed, which is delicately striate, with 10 or 12 ribs visible (on one side), and distinctly cross-lined; it is one of the very few species in which we find the appendages as long as, or longer than, the seed itself.

14. J. Hallii, n. sp.: cæspitosus; caulibus (spithameis pedalibus) teretibus filiformibus folia teretia setacea longe superantibus; spatha paniculam subsimplicem paucifloram coarctatam vix seu parum superante; sepalis lanceolatis acutis, exterioribus paulo longioribus stamina 6 bis superantibus; antheris linearibus filamento paulo brevioribus; stigmatibus subsessilibus ovarium ovatum æquantibus inclusis; capsula ovata angulata retusa triloculari vix exserta; seminibus oblongo-linearibus striato-reticulatis longe caudatis.—*J. arcticus,* var. *gracilis?* Gray in Pl. Hall & Harb. l. c. p. 77, ex parte.

Near Lake Ranch, Colorado, *Hall & Harbour*, Rocky Mountain Flora, No. 562; for the former of whom, Mr. E. Hall, of Athens, Menard county, Ill., who discovered this and many other plants in that region, it is named. It seems to be a rare plant, as neither Dr. Parry nor any one else, so far as I know, has obtained it.—Stems very slender, 6–12 inches high; leaves from 2–5 inches long, grooved just above the vaginal part, terete upwards; spathe as long as, or a little longer than, the compact inflorescence, which consists of 2–5 flowers about 2 lines long; capsule deep brown, as long as, or longer than, the acute but not subulate-pointed, chestnut-brown, white-margined sepals; seeds 0.5–0.6 line long, the body of the seed being about 0.3 line long, and the appendages half as long as the body, or often shorter; I notice on one side of the seed about 10 delicate ribs.

15. J. Parryi, n. sp.: cæspitosus; caulibus setaceis humilibus (digitalibus spithameis) folia sulcata sursum teretia superanti-

bus; spatha paniculam simplicissimam (1–3-floram) superante; sepalis lanceolato-subulatis, exterioribus longioribus aristatis stamina 6 ter superantibus; antheris linearibus filamento bis terve longioribus; stigmatibus ovarium lineari-prismaticum in stylum attenuatum vix æquantibus inclusis; capsula prismatica acutata exserta triloculari; seminibus oblongis tenuiter striato-costatis longe caudatis.—*J. arcticus*, var. *gracilis?* Gray in Pl. Parry, p. 34, and in Pl. Hall. & Harb. l. c. ex parte.

On the western and north-western mountains; *Dr. C. C. Parry*, the indefatigable explorer of those mountain regions, who has been so often mentioned in the pages of these Transactions, and for whom I have named this interesting little plant, discovered it in Colorado in 1861 (coll. No. 360); *Messrs. Hall & Harbour* found it in the same region (No. 561), *Dr. Hillebrand* in the Sierra Nevada, and *Dr. Lyall* in the Cascade Mountains; it is generally, as it seems, associated with *J. Drummondii*.—Stems very thin and wiry, 4–8 inches high, leaves one-half to two-thirds as long, deeply grooved for over half their length, terete upwards; spathe usually overtopping the flowers, often 1 inch or more long; flowers mostly two, very rarely three in number, $2\frac{1}{2}$–$3\frac{1}{2}$ lines long, larger than those of the two last species, and distinguished by their bristle-pointed exterior sepals, which are greenish, with brown sides and white margin, and strongly nerved. After maturity the placentæ of the slender and very acute brown capsule become detached from the valves and persist in the center. The whole seed is about 1 line, and the body alone about 0.4 line long; longitudinal ribs 10–12 on one side, cross-lines very faint. A Californian specimen before me has somewhat shorter capsules and smaller and thicker seeds, but shows no other difference.

16. J. TRIFIDUS, Linn., apparently a rare plant in North America; thus far found only on the highest mountains in New York, New Hampshire, and Maine, and in Newfoundland and Greenland.—American specimens do not differ from those of Europe. The seeds are few and large, irregularly compressed, very faintly striate, with very short appendages; 0.7–0.8, or even as much as 1.1 lines long, and 0.3 line or more in diameter.

17. J. BIGLUMIS, Linn.: the only American localities known to me are those given by Hooker (Fl. Bor. Am. 2, 192)—"Arctic sea coast and islands, Rocky Mountains north of Smoking River, and Behring's Straits." A specimen from the Arctic sea coast, which I had the opportunity of examining, does not differ in any respect from the Norway and Lapland plant. The body of the seed is ovate-oblong, 0.34–0.42 line, and with the appendages 0.66–0.72 line, long; these are equal to, or shorter than, the diameter of the seed. In a Scotch speci-

men I have seen a regularly tetramerous flower, with 8 sepals, 8 stamens, and a 4-valved capsule. The leaves, which botanists do not seem to agree upon, appear to me fistulous, on the lower half so deeply grooved as almost to present two cavities, and upwards nearly terete or slightly flattened. Its alliance with *J. Parryi* is indeed very close.

18. J. TRIGLUMIS, Linn., on the Arctic coast and in the Rocky Mountains; in Colorado, *Parry*, 395, and *Hall & Harbour*, 557.—The seeds are of the same size as in the last species, but the appendages are much longer, though only in a specimen from Zermatt, Switzerland, I have seen them longer than the body of the seed. The roundish leaves are channelled below and flattened upwards, and really enclose two, or even three, tubular passages.

19. J. STYGIUS, Linn. From North-western New York to Maine, New Brunswick, and Newfoundland. The seeds of this are the largest of any of our species; the body is 0.7–0.8, and the whole seed 1.5 lines long; the seed-coat, extremely loose and easily removed, is scarcely striated. Mention has already been made of the short and recurved stigmas which are peculiar to this species; the filaments are 8 or 10 times as long as the oval anther, and much longer than the pistil; the flowers, in the American specimens examined by me, are 3 lines long, while in one from Norway I find them only 2 lines long. A careful examination of the leaves proves them to be somewhat laterally compressed, with a very shallow groove on their lower part (generally a little on one side), and the interior cavity filled with very loose tissue which divides it into several (3–5) tubes.

20. J. CASTANEUS, Smith; the lower part of the terete, fistulous leaves is so deeply channelled that their base appears equitant, and that in the herbarium the pressed leaves look like the averse and ensiform leaves of *J. xiphioides;* but their back is rounded and not in the least carinate, and the upper part of the leaf is only very superficially grooved. The flowers are usually over 3 lines long, and the stamens, as well as the elongated ovary with the short style, attain the length of the sepals; linear, pointed anthers half as long as the filaments; stigmas exsert; oblong seeds, 0.4–0.5 line, or with the appendages, which considerably exceed the seed in length, 1.6 lines or more, long, the longest of any of our species.—From the Rocky Mountains of Colorado to the north-west coast, and eastward to the Hudson Bay regions and to Newfoundland.

21. J. VASEYI, n. sp.: cæspitosus; caulibus (1–2-pedalibus) tenuibus rigidis striatis basi fusco-vaginatis; foliis elongatis setaceis teretiusculis striatis versus basin sulcatis faretis;

spatha paniculam parvam contractam æquante seu raro superante; sepalis æquilongis lanceolatis, exterioribus apice subulatis, interioribus latioribus mucronatis stamina 6 plus quam duplo superantibus; antheris filamenta æquantibus; stigmatibus ovarium ovatum cum stylo brevi vix æquantibus inclusis; capsula straminea ovata sursum tricocca retusa triloculari sepala æquante seu paulo superante; appendicibus semini ipso lineari costato-lineolato paulo brevioribus.

On the banks of Fox river, near Ringwood, in Northern Illinois, "a few years ago, in an open wood, now plowed over," *Dr. George Vasey*, who paid a good deal of attention to this genus and to the botany of his neighborhood generally, and for whom this species is named; on the Saskatchawan, *Bourgeau;* in the Rocky Mountains, *Drummond;* and, mixed with *J tenuis*, in Colorado, *E. Hall.*—The wiry stems, 1 or 1¼ to 2 or 2¼ feet high, are covered at base with brown sheaths, the innermost of which bear very slender terete leaves, shorter than the stem, and channelled only near the base, so that our plant is thus most closely allied to those of the first section; its inflorescence, however, is decidedly terminal, and connects it with *J. tenuis* and its relatives. The compact panicle is ½–1 inch long, green, or, when fully ripe, of a light brownish straw color; flowers 2 lines long; seeds very slender, body about 0.3, and with the appendages, 0.5–0.7 line long. This species is the western representative of *J. Greenii*, from which it is distinguished by the longer stems, the terete, scarcely channelled leaves, the lighter colored flowers, the shorter capsule, and by the slender seeds with longer appendages.

22. J. Greenii, Oakes & Tuckerm. Sillim. Journ. 45 (1843), p. 37; Steud. Glum. 2, 305; Gray Man. ed. 2, 483; cæspitosus; caulibus (pedalibus sesquipedalibus) rigidis strictis striatis basi parce stramineo-vaginatis; foliis caule brevioribus teretiusculis totis profunde sulcatis; spatha paniculam contractam ad ramos ultimos secundifloram plerumque longe superante; sepalis (stramineo-fuscis) lanceolatis subulatis subæqualibus seu interioribus paulo brevioribus cuspidatis stamina 6 duplo superantibus; antheris filamenta æquantibus; capsula ovato-oblonga retusa sepala excedente (pallide fusca) triloculari; seminibus obovatis costato-lineolatis breviter caudatis.

On the coast of Massachusetts and Rhode Island (to Long Island?) and on the Saco river at the foot of the White Mountains.—Few and pale sheaths at the base of the stem; leaves deeply channelled all their length; panicle contracted, with erect, one-sided branches, 1–1½ inches long; flowers 1.7–1.8 lines in length; seeds 0.25–0.30 line, and with the appendages, 0.37–0.40 line long, appendages about half as long as the diameter of the seed.

23. J. TENUIS, Willd., is one of the most common and best known, but also one of the most variable species, and can always be readily distinguished from all the allied ones by its flat leaves, which only in the narrow-leaved forms are on the margin slightly involute; by the lanceolate, subulate sepals of equal length, which somewhat exceed the ovate, retuse capsule, and principally by the small, mostly oblique, delicately lineolate seeds, with distinct but short, whitish appendages; they are very similar to those of *J. effusus*, and are mostly 0.25–0.28, rarely only 0.20 line long.

Notwitstanding the great variability in the size of the plant (from a few inches to two feet), in the size and development of the one, two, or even three spathes, and in the size and fullness of the inflorescence (1–5 or 6 inches in length), I can distinguish only the following well marked varieties:

Var. β. *secundus*, ramis paniculæ spatham excedentibus erectis incurvis; floribus minoribus secundis.—*J. secundus*, Poir.

Var. γ. *congestus*, ramis paniculæ spatha brevioribus abbreviatis; floribus fere in capitulum congestis; sepalis fusco-striatis; capsula e stramineo fusca.

The legitimate *J. tenuis* is found over the whole country, from the Atlantic to the Pacific, and south into the tropical parts of America, in the West Indies, and in western Europe. —The interesting and quite distinct looking variety with unilateral flowers has usually 4 or 5, but sometimes even 6 or 7, flowers on a single* branch, which is curved inward and not backward, as is the case in *Borragineæ*, the one-sided inflorescence of which bears a great analogy to that of our plant. Most of the specimens of this variety which fell under my observation were obtained in Pennsylvania, and a few in New England; forms approaching it are found in other regions also.—The variety γ, which occurs in California (San Francisco, *Bolander;* Monterey, *Brewer*) and in Colorado, *Hall*, is very striking; its apparent heads, 4–9 lines in diameter and nearly as high, bear flowers a little larger than ordinary, with darker colored sepals. The seeds of both varieties are undistinguishable from those of the common plant.

24. J. DICHOTOMUS, Elliott, Sketch, 1, 406; Chap. Flor. 493; though closely allied to the preceding, is a well marked species, and would not have so often been confounded with it, if the characters, as given by Elliott, had not been overlooked. The terete leaves, which are marked by a shallow groove on their upper side, distinguish it at once, even when

* These branches are only apparently single axes, for in reality they are formed of many short, successive branches.

the subglobose, mucronate, but never retuse, capsule is not yet formed. The seeds are very similar to the smaller ones of *J. tenuis* (0.22–0.23 line long), and have the same oblique white appendages, but they are coarsely lineolate, the meshes being about twice as wide as in the other species; the bulbous base of the stem, indicated by Chapman, is perhaps not always so well marked. Mr. Bebb remarks that about Washington, where it is abundant, the contrast in the color of the mature plants of this and the last species is quite striking; the latter becomes pale throughout, while *J. dichotomus* remains dark green, and the ripe pods assume a mahogany color.—The northern limit of this species seems to be on the Chesapeake bay, whence it extends to Florida.

25. J. Gerardi, Lois. notic. (1810) p. 60, ex Kunth En. 3, 352; Koch syn. Germ. 731, is well distinguished from *J. bulbosus*, Linn., which has never, I believe, been found in America, by the subterete stem, the much larger flowers, which are as long as the capsule; by the large linear anthers and very short filaments, the long style, which is equal to the ovary, and by the larger seeds. These are 0.31–0.33 line long, while those of *J. bulbosus* are only 0.23 line long; both are delicately lineolate.—It is a salt water plant, and is found in brackish marshes from the British possessions to North Carolina, *Curtis*, and Florida, *Ware* (*J. Floridanus*, Raf. in Hb. Durand); inland it has been found by *Judge Clinton* about Salina, Western New York; and near Chicago by *Dr. Vasey*. On the coast of New England it is well known under the name of "black grass," and is cut in large quantities and makes pretty good hay (*Oakes*).

26. J. bufonius, Linn.; this well known weed, found all over the globe, and, perhaps with the exception of *J. saginoides*, the only annual *Juncus* of our Flora, is most variable in its size, the size and disposition of the flowers, the proportion of inner and outer sepals, and the size of the seeds. The seeds are ovate, very obtuse, and commonly very slightly apiculate, and delicately lineolate; 0.15–0.20 line is their usual length; I have rarely seen them 0.22 l. long, and in a Galveston specimen have found them only 0.13 l. long.

Only one marked variety has been distinguished under the name of *fasciculatus*, Koch, or *fasciculiflorus*, Boiss., apparently a southern form, common in our south-eastern States and in the south of Europe; it is also found in the interesting colony of southern plants near the Philadelphia navy-yard; the last three or four internodes of the branches of the inflorescence are so much shortened that the flowers become crowded into false heads, which gives the plant a very peculiar aspect.

27. J. REPENS, Michx. Fl. 1, 191; *Cephaloxys flabellata*, Desv.; Chapm. Flor. 496; a well marked south-eastern species, found from Maryland, *Canby*, to Florida, Alabama, and Louisiana; it is a true *Juncus*, as I have shown above, and evidently, notwithstanding its great difference, nearly allied with the last species. Seeds obovate, somewhat pointed, about 0.2 line long, and delicately lineolate.

28. J. FALCATUS, E. Mey. Synops. Luzul. p. 34; in Rel. Hænk. 1, 144, et in Led. Fl. Ross. 4, 228, exc. syn.; Kunth En. 3, 360: rhizomate ascendente stolonifero; caulibus (digitalibus pedalibus) erectis lævibus compressis unifoliatis seu nudis; foliis gramineis planis adversis plerumque oblique ad latus deflexis inde falcatis; capitulis sub-singulis spatha sæpius brevioribus; floribus (majoribus castaneis) extus scabris pedicellatis; sepalis ovatis, exterioribus acuminatis interiora obtusa subinde mucronulata æquantibus seu eis brevioribus; staminibus 6 dimida sepala superantibus ovarium obtusum cum stylo ei æquilongo æquantibus, antheris late linearibus filamento multo longioribus; stigmatibus elongatis exsertis; capsula obovata obtusa mucronata triloculari; seminibus (ex Hooker) testa producta lineari-oblongis.—*J. Menziesii*, R. Brown in Hook. Fl. Bor. Am. 2, 192.

From the Russian island of Unalaschka, *Chamisso*, to California, *Hœnke*, *Eschscholtz*, *Douglas*, *Coulter* 808, *Bolander*, and on the Cascade Mountains, 49 deg., *Lyall*.—A very striking and much controverted plant, as distinct from *J. castaneus* as it is from *J. ensifolius* and *J. Mertensianus*, with all of which different authors have thrown it together; the perfectly flat and adverse (*i. e.* the flat surface facing the stem) leaves, the very broad and scabrous sepals, and the long anthers on short filaments, distinguish it fully from all these.—Eschscholtz's specimens in Hb. Gray are only 1½–3 inches, while those of Lyall are 15 inches high; 6 or 8 inches is their usual size. The leaves are of different lengths, shorter than, or sometimes exceeding, the stem, and are usually laterally bent so that even the stipular appendages of the sheath are unequal. Heads mostly single, sometimes two or three, ½ inch in diameter, composed of from 8 to 18 large (3 lines long) flowers; sepals remarkably broad and rough on the outside, chestnut-brown or (in Coulter's and Lyall's specimens) green, with two lateral brown stripes; this roughness seems to be constant in this species, and in no other have I seen it. Meyer (Rel. Hænk. l. c.) says of the fruit in Chamisso's specimen: *trigono-pyriformis perianthio paulo longior triloculares; seminum testa laxior albicans sed non scobiformis;* none of the specimens before me have ripe fruit, only one, from the Cascade Mountains, shows a half developed capsule with young seeds, and these are undoubtedly tail pointed and

already 0.6 line long; Dr. Hooker (Bot. Antarct. Voy. Fl. Tasm. 2, 64) speaks of the seed of this species as "linear-oblong, striate, with the testa produced beyond either end," and as the Tasmanian plant* has very different seeds, his remark must refer to the Californian species.

Hooker & Arnott, Bot. Beechey, p. 402, distinguish from the original *J. Menziesii*, with obtuse sepals, the variety *Californicus*, with acuminate ones; I have found, in all the specimens, examined by me, the outer sepals acuminate and the inner ones obtuse, with or without a mucro; but in some, as stated before, the outer ones are much shorter than, in others as long as, the inner ones.

29. J. LONGISTYLIS, Torrey in Bot. Mex. Bound. p. 223: caulibus (pedalibus bipedalibus) cæspitosis stoloniferis teretiusculis sursum sæpius (sub lente) scabriusculis foliatis; foliis planis gramineis; capitulis paucis in paniculam contractam aggregatis seu raro singulis; floribus (majoribus viridulis fusco-striatis) lævibus pedicellatis; sepalis æqualibus ovato-lanceolatis acutatis seu cuspidatis stamina 6 duplo superantibus; antheris filamento sub-duplo longioribus; ovario stamina et stylum æquante, stigmatibus exsertis; capsula ovata obtusa mucronata seu rostrata castanea nitida triloculari calycem æquante seu paulo superante; seminibus oblanceolatis seu obovatis apiculatis costato-reticulatis.—*J. Menziesii*, Gray in Pl. Parry, p. 34, and Pl. Hall & Harb. p. 77, "the var. *Californicus*, Hook & Arn., probably an unpublished species."

Rocky Mountains from New Mexico, *Wright* 1924, *Fendler* 857, to Fort Whipple, Arizona, *Coues & Palmer*† 48, and northward to Colorado, *Parry* 631, *Hall & Harb.* 566, to the Saskatchawan, *Bourgeau*, and towards Oregon, *Lyall.*— Stems cespitose, or, probably in richer soil, stoloniferous, 1–2 feet high; panicle usually 1½–2½ or 3 inches long, consisting of 5–9 heads; heads 3–8 or 12-flowered, sometimes fewer or single, and then 12-15-flowered; flowers 2½–3 lines long;

* The Tasmanian *J. falcatus*, Hook. f. l. c., of which I find a good specimen with ripe fruit, collected by Gunn, in Hb. Gray, is certainly very similar, but seems to be distinguished by smaller but also scabrous flowers; ovate, retuse capsules of the length of the equal, acutish sepals; and obovate, obtuse, abruptly apiculate reticulate seeds, the areæ of which are *perpendicularly* lineolate; it might be distinguished by the name of *J. Tasmanicus*.

† While this sheet was in the hands of the printer I received a most interesting collection of Arizona Plants, made last year by Drs. Elliott Coues, and Edward Palmer, in which I found good specimens of this species, and also some of *J. compressus*, unfortunately again without fruit; the leaves of this last, however, are finely developed, thus adding another proof for the opinion, that it is really a regularly leaf-bearing species. (Compare p. 440.)

stamens as long as the ovary, so that the style, which is of the same length, protrudes beyond them; seeds 0.25–0.27 line long, oblanceolate and acute, or, in the Fort Whipple specimens, obovate and upwards obtuse; these specimens are also distinguished by the absence of all traces of stolons, and by the slightly roughened surface of the upper part of the stem.—From the closely allied *J. falcatus* our plant is distinguished by the greater size, the paniculate heads, the shape, proportion, and surface of the sepals, and the shape of the seeds.

30. J. LEPTOCAULIS, Torrey & Gray in Herb. Durand: caulibus cæspitosis erectis (spithameis pedalibus) gracilibus compressiusculis fistulosis paucifoliis; foliis planis caule brevioribus; capitulis singulis seu paucis (1–3) spatham fere æquantibus 3–6-floris; bracteis ovatis aristatis flore subpedicellato plerumque brevioribus; sepalis ovato-lanceolatis acuminato-aristatis æqualibus seu exterioribus paulo brevioribus stamina 3–6 et capsulam obovatam tricoccam retusam mucronatam trilocularem quarta parte superantibus; antheris oblongo linearibus filamento bis terve brevioribus; stigmatibus ovarium obovatum cum stylo perbrevi æquantibus inclusis; seminibus obovatis apiculatis costato-lineolatis. — *J. filipendulus*, Buckley in Proc. Acad. Phil. 1862, p. 8.

Arkansas, *Herb. Durand*, Western Texas, *Lindheimer*, *Wright*, *Buckley*.—Whole plant light green; gracile stems 6 or 8 to 12 and 14 inches high, growing in dense tufts from very small but apparently perennial rhizomas; heads single or, rarely, two or three, the secondary ones pedunculate and overtopping the primary one, in fruit 4–5 lines in diameter, consisting of 3–6 or 7 light green flowers; flowers not quite 2½ lines long, remarkable for the elongated sharp points of the inner as well as the outer sepals, and for the irregular number of stamens; stamens sometimes 3, often 4 or 5, rarely 6, some of the inner ones commonly depauperate, with very slender filaments and extremely small anthers; seeds very similar to those of the next species, 0.22 line long, with about 6 strong and dark ribs visible on one side.

I had to change the only published name of this species, *J. filipendulus*, because it is absolutely wrong, the fibrous rootlets bearing no tubers at all; intending to substitute the name of the author and call it *J. Buckleyi* (p. 435), I discovered, from a label in Mr. Durand's herbarium, that Torrey and Gray had already named the species, I therefore adopt their very appropriate designation.

31. J. MARGINATUS, Rostk. Mon. Junc. 38, t. 2, f. 2; a well known species which grows all over the eastern and interior States, and down to Texas as far as woodlands extend, but has not been found in the western plains or mountains. It is

distinguished from all our other species by the purple, or, when dry, red-brown color (already noticed by La Harpe) of its three anthers, which usually exceed the outer sepals in length; it is further characterized by the acute outer sepals being much shorter than the obtuse or, sometimes, mucronate inner ones; by the ovate, obtuse ovary, with the almost sessile, enclosed stigmas of the same length; and the subglobose, obtuse, mucronulate capsule. The seeds are quite variable in size and form, but always strongly pointed or almost caudate and conspicuously ribbed, with few (4 or 5, or, at most, 6) ribs visible, lineolate or, rarely, reticulate; they are commonly slender, obliquely lanceolate or fusiform, but in Lindheimer's Fl. Tex. exsicc. 193, which has been named *J. heteranthos*, they are quite short, ovate obtuse and abruptly apiculate. The length of the seeds varies from 0.22 to 0.33 line, and their thickness from $\frac{1}{4}$ to $\frac{1}{2}$ of their length. —*J. aristulatus*, Michx. 1, 191, and *J. aristatus*, Pers. Syn. 1, 385, are exactly the same; *J. biflorus*, Ell. Sketch, 1, 407,* and *J. heteranthos*, Nutt. Pl. Arkans. in Trans. Am. Phil. Soc. V. 153, are forms of the same with fewer flowers in the head. *J. cylindricus*, Curtis, Sillim. Journ. 44, 83; Steud. Glum. 2, 304, is a form with heads elongated into spikes 6 lines long and 3 lines in diameter, sterile below, only the uppermost flowers bearing fruit; outer sepals almost as long as inner ones.

We may distinguish the following forms:

Var. *α. vulgaris*, $1\frac{1}{2}$–3 feet high, with 5–8-flowered heads in a compound or decompound panicle; the common form.

Var. *β. biflorus*, as tall as the former, with 2–3-flowered heads in a decompound, often very large, panicle; a southern form, from Delaware, *A. Commons*, to Texas.

Var. *γ. paucicapitatus*, 1–$1\frac{1}{2}$ feet high, with few (2–6 or 8) larger 8–12-flowered heads; Long Branch, New Jersey, *C. W. Short*, and elsewhere.

32. J. PELOCARPUS, E. Mey. Synops. Luzul. p. 30; La Harpe Monog. 124; Kunth En. 3, 333, non Auct. Amer.: rhizomate horizontali tenui pallido; caulibus (spithameis pedalibus et ultra) gracilibus teretiusculis erectis paucifoliis; foliis teretiusculis indistincte nodulosis; paniculæ decompositæ laxæ ramis plerumque elongatis secundifloris demum recurvis; floribus (parvis) singulis binisve sæpe in gemmam vel ramulum foliosum abortientibus; sepalis oblongis obtusis, exterioribus plerumque brevioribus rarius mucronatis stamina 6 et ovarium acuminatum in stylum breviorem abiens vix superantibus; antheris late linearibus filamento multo (duplo

* The inner sepals, however, are not the shortest, as the usually so careful and reliable Elliott, probably by a lapse of the pen, says, but, as in all the forms of this species, the longest.

quadruplo) longioribus; stigmatibus exsertis; capsula triquetra acuminato-rostrata 1-loculari exserta; seminibus obovatis breviter apiculatis reticulatis, areis lineolatis.—*J. Muhlenbergii*, Spreng. Syst. 2, 106 (1825); *J. viviparus*, Conrad in Journ. Ac. Phil. 6, old ser. part 1, p. 105; *J. Conradi*, Tuckerm. in Torr. Fl. N. Y. 2, 328 (1843); Gray Man. ed. 2, 482; Chapm. Fl. 495; *J. dichotomus* in herb. plur.

Var. β. *crassicaudex*, e rhizomate crasso caulibus foliisque robustioribus.—*J. abortivus*, Chapm. Fl. l. c.

Var. γ? *subtilis*, caule reptante vel fluitante radicante folioso; foliis brevibus setaceis ex axillis proliferis; floribus subbinis 3-andris.—*J. fluitans*, Michx. Fl. 1, 191; *J. subtilis*, E. Mey. Syn. Luz, 31; La Harpe Mon. 135.

From Newfoundland (ex La Harpe) and Canada, *Macrae*, westward to Lake Superior, *Robbins*, and southward, chiefly along the coast, to South Carolina, *Curtis;* var. β. in Florida, *Chapman;* var. γ. in Canada, *Herb. Michaux.*—A very peculiar and, morphologically, very important plant, the synonymy of which has been quite obscure. Meyer's original diagnosis is too short, so that it permits strong doubts about the identity of the plant he had in view, and his unfortunate comparison of his species with *J. lampocarpus* and *J. paradoxus*, "*cujus habitum refert*," necessarily throws botanists on the wrong track. But La Harpe,* who wrote only two years after Meyer's publication, and who seems to have been well acquainted with Meyer and with his species, gives a full description which can leave no doubt, even if Meyer's herbarium did not settle the difficulty. Though originally the species was described from specimens in C. Sprengel's collection, which seem also to have been the originals of his *J. Muhlenbergii* (most probably received from Muhlenberg himself), several specimens, obtained later from different sources (*e. g.* E. Tuckerman and A. Gray) are preserved in Meyer's herbarium with the name of "*J. pelocarpus*" in his own handwriting; and others, named by him, are found in the royal herbarium at Berlin. Now, this plant is so peculiar that no one who has ever examined it can confound it with any other;

* Jean de La Harpe's "Monographie des vraies Joncées" seems to be little accessible to botanists; it was published, 1825, in the third volume of Mémoires de la Société d' Histoire Naturelle de Paris, p. 89–181, and is a work of careful research, in which I believe I can trace the conscientious investigation and the critical spirit of my old and highly esteemed, now departed, friend, Jacques Gay, of Paris. La Harpe was the first to give full and careful descriptions of these plants and of all their organs, and only after the date of his publication we find in Meyer's papers similar extended accounts in place of the former short diagnoses, *e. g.* in the *Junci* of the *Reliquiæ Hœnkeanæ*, published 1827. Not having been able to compare Michaux's original plants, I have with confidence relied on the critical references of La Harpe, especially in regard to species about which doubts had existed, such as *J. fluitans, acuminatus,* and *polycephalus.*

is it, then, at all probable that Meyer himself should have done so in his own herbarium? His original specimens may not have exhibited the foliaceous excrescences, so that he could not mention them in his description of this species, while he did allude to similar ones in his account of his *J. paradoxus;* his diagnosis is so short that he does not even mention the unusually small number of flowers.

The rhizoma is whitish and slender, often almost filiform, and sends out few and distant, or sometimes more crowded, slender and almost terete, not flattened, stems, 4 or 6 to 18 or 20 inches high; leaves slender, almost setaceous, scarcely compressed, and incompletely knotted. The panicle shows very different forms in different specimens; sometimes, probably in the earlier part of the season, it is only 2 or 3 inches long, and moderately spreading, with flowers more crowded; but usually, at least in the numerous herbarium specimens examined by me, and perhaps later in the season, it attains a length of 4 or 6 inches, with about the same diameter, the few slender spreading or recurved branches bearing the distant flowers on one side. The flowers are green, with a reddish tinge, especially on the inner sepals, usually 1.0–1.3 lines long, and generally single; sepals obtuse, sometimes mucronate, or, rarely, the outer ones acutish; these are generally shorter than the inner ones; but in a Lake Superior specimen the flowers are only 0.8 line long, and all the sepals equal, broadly oval and obtuse. Stamens about the length of the outer sepals, anthers always longer than filaments, sometimes scarcely twice as long, in others fully four times their length. Style shorter than the acuminate ovary. The capsule ought not to have been described as Meyer and (copying him) La Harpe did, as *triquetro-ovata mucronata;* it is rather, as Gray has it, taper beaked, and is completely one-celled, the lateral placentæ occupying only the lowest third or fourth part of the commissure of the valves. Seeds 0.25 line long, delicately but distinctly reticulate, areæ transversely lineolate.

I cannot distinguish Dr. Chapman's *J. abortivus* from the northern plant except by the not essential characters given above; the flowers are absolutely identical, and fruit I have not seen.

With some hesitation I add *J. subtilis* as a procumbent or floating variety with short internodes, and short leaves which bear leaf-buds in their axils. In American collections this form does not seem to exist, but La Harpe, who saw it in Michaux's herbarium in Paris, gives a full description of it, from which I have extracted above; the flowers are described exactly like those of *J. pelocarpus*, and there is, notwithstanding the different habit, nothing in it that would specifically distinguish it, except the smaller number of stamens, and the

single, two-flowered heads; fruit and seed are unknown. I take it for a depauperate water form of our species, while Hooker, Fl. Bor. Am. 2, 191, unites it with *J. uliginosus*, which with him is what I have taken for *J. alpinus;* but that is also a 6-androus species. The botanists of Canada and of our northern border ought to find it again and clear up these doubts.

I have already (p. 426) spoken of the great morphological importance of this plant, which connects the single-flowered with the head-flowered species, and proves, as certainly might have been expected beforehand, that no absolute difference exists between them; that the flowers in all of them are really lateral; that in the former only one flower is formed, while in the others a series of them, from two to an indefinite number, are developed in centripetal order. In our species a second flower is more commonly not present, and its place is occupied by a bud, which often, and especially later in the season, grows to a leafy excrescence (whence the name *viviparus*); sometimes even the first flower is replaced by a leaf-bud, and in rare instances a leaf-bud makes its appearance between two flowers as a third axillary organ. I have never seen more than two flowers, nor more than one leaf-bud in a head. Botanists who have the opportunity ought to investigate the variations in the inflorescence of this plant according to locality, season, or other circumstances.

33. J. ARTICULATUS, Linn.; that form of the Linnean species which was distinguished by Ehrhart as *J. lampocarpus*, and which is common in northern Europe, has a very limited range in North America. All the specimens I have seen came from the New England States (Boston, *Pickering;* Amherst, *Tuckerman;* and Providence and Nantucket, *Olney*) and from western New York (Penn Yan, *Sartwell*); to these La Harpe adds Newfoundland.—Stems densely cespitose from a creeping root-stalk, with us usually erect and about one foot high; panicle short, dense-flowered, spreading, brown; sepals mostly equal, lanceolate acute and mucronate, or inner ones slightly longer and sometimes obtusish; stamens about two-thirds the length of the sepals, and anthers as long as filaments; ovary acuminate, terminating in a style about half its length; capsule longer than the sepals, acute, or even rostrate, at least in all the American specimens seen by me, and imperfectly three-celled, the placentæ not meeting in the centre. Seeds obovate, obtuse at the upper, acute at the lower, end, and at both strongly apiculate; 0.3 line or a little less long, and about half as much in diameter; reticulate, with areæ finely cross-lineolate; 7 or 8 ribs visible.

34. J. ALPINUS, Villars, Delph. 2, 233 ex Koch Syn. Germ. 730; *J. fusco-ater*, Schreb. ex Kunth En. 3, 326, *J. affinis*,

ERRATA.

Page 304, line 7 from below, instead of "*absolute,*" read *obsolete.*
" 425, " 23 " top, " "*root-stalk,*" " *root-stock.*
" 458, " 15 " below, " " " "
" 432, " 23 " top, " "*rudis,*" " *microcephalus.*
" 435, " 16 " " " "*Buckleyi,*" " *leptocaulis,* T. & G.
" 483, " 8 " " " " " " " "

R. Brown, *J. Richardsonius*, Rœm. & Schult., *J. pelocarpus*, Gray Man. ed. 1, 507, in part, non Mey., *J. articulatus*, var. *pelocarpus*, Gray Man. ed. 2, 482, in part; *J. elongatus*, Vasey, in herb.—This form ought, perhaps, not to be separated from the last species, but with us it is easily distinguished, and occupies a distinct geographical range; I, therefore, keep them apart for the present, and leave the final decision to the botanists of Europe, where both forms are much more abundant.—With us this species is confined to the northern and western parts of the continent, where it is usually found on the sandy or gravelly banks of lakes or streams; from Lake Champlain, *Robbins*, *Macrae*, and Seneca and Ontario lakes, *Sartwell*, where it meets the eastern, *J. articulatus*, northward to the Hudson Bay regions, *Drummond* and others, and the Arctic shores, and westward along the great Lakes to Detroit, *Bigelow*, *Herb. norm.* 51, northern Illinois, *Vasey*, and the upper Platte, *Hayden*, Colorado, *Hall & Harb.* 558, and beyond the Rocky Mountains toward Fort Colville, *Lyall.*

Stems erect from a creeping rootstock, 10–18 inches high; branches of the meagre panicle, at least in the larger specimens, strictly erect and much elongated, greenish and light brown; sepals oblong, obtuse, outer ones mucronate or cuspidate, equal to, or exceeding, the rounded inner ones; stamens same as in last; ovary ovate, with a very short style; capsule as long as, or a little longer than, the sepals, obtuse, mucronate, incompletely three-celled; seeds very similar to last, but usually more slender, oblanceolate and acute at both ends, rarely obtuse at the upper one, 0.30–0.35 line long.—The alpine form of this plant, the original type of Villars, is found in our Arctic regions, and is only a few inches high, bearing very few almost black heads, and has the slenderest and longest seeds. The ordinary American plant is distinguished from the usual European form by its lower stems, still stricter panicle, and paler flowers and fruit. Fries has sent absolutely the same from Sweden, formerly as *J. sylvaticus*, and as *J. acutiflorus*, and later as *J. alpinus*, var. *insignis*, which name may be retained for it.

35. J. DUBIUS, n. sp.: rhizomate crasso horizontali; caulibus (1½–3-pedalibus) erectis cum foliis tereti-compressis; panicula supradecomposita patula; capitulis pauci-(6–10)floris stramineis; floribus subsessilibus; sepalis lanceolato-subulatis acutissimis æqualibus stamina six fere duplo superantibus; antheris linearibus filamento sublongioribus ; capsula lineari-prismatica acutata uniloculari exserta; seminibus obovatis utrumque apiculatis areis lineolatis reticulatis.

Forming large tufts in wet granitic sand in Clark's meadow, near the Big Tree Grove, Mariposa, California, at an altitude of 6,500 feet, *H. Bolander*, fl. & fr. in July; Cal. State Surv.,

6032, IIb. norm. 52. With a good deal of hesitation, expressed in the specific name given to this plant, I venture to separate it from the closely allied *J. oxymeris* of the same region. Its rounded and only slightly compressed leaves certainly seem to be very distinct from the flattened equitant leaves of the latter species, but otherwise the whole appearance, the rhizoma, the panicle, the flower, the stamens even, and the fruit, show scarcely any difference; only the seed proves distinct, and as, I believe, we can safely rely on characters derived from the sculpture of this organ, we must consider both as really distinct species. The seeds of *J. oxymeris* show on one side 7–9 ribs and a distinct reticulation, the areæ being smooth, and only the ribs slightly crenulate; *J. dubius* has seeds of the same size (0.22–0.25 line long), but with fewer (5–7) ribs, and larger, strongly lineolate areæ. The panicle of this plant is 3–5 inches long, the flowers slender, and with the capsule nearly 2 lines long.

36. J. MILITARIS, Bigelow, Flor. Bost. ed. 2 (1824), p. 139; Gray Man. ed. 2, p. 482, was "discovered by *B. D. Greene* at Tewksbury," and has since been traced from Maine, *Blake*, to Massachusetts, and southward to the Pocono Mountains in Pennsylvania, *T. Green*, New Jersey, *Asa Gray*, *C. F. Parker*, Maryland, *A. Commons*, and, if there is no error in the label, as far as Alabama, *Drummond*.—The stout stems, 2–4 feet high, spring from a creeping rootstock, and bear on their lower half a single leaf, ½–3½ feet long, which usually overtops the inflorescence, and is mostly followed by a second very short one, rarely developed beyond the vaginal part. The decompound, rather crowded, and often somewhat contracted light brown panicle is 2–5, usually about 3, inches long; the heads are 5–12 flowered, only in a Maryland specimen I find them 15–25 flowered. Flowers (in the North in August) 1½ lines long; sepals lanceolate, outer ones subulate-pointed or even aristate, mostly very little shorter than the acute inner ones; stamens 6, two-thirds the length of the sepals; linear anthers a little longer than the filaments; stigmas exsert, as long as the ovate acuminate ovary and the distinct style together; capsule sharply triangular, ovate, acuminate, rostrate, equalling or slightly exceeding the sepals, one-celled; seeds obovate, obtuse, unusually thick, and abruptly apiculate, 0.25–0.30 line long, and three-fifths of their length in diameter, neatly reticulate, the areæ marked with few longitudinal lines; 8–10 ribs visible.

Dr. Robbins has discovered a very curious peculiarity of this plant, which abounds in the Blackstone river, near Uxbridge, Massachusetts, and its tributaries, and in the flumes of the manufactories, but only in rapid parts of these streams, and is there not found in sluggish streams or in stagnant

water. It seems that about the period of maturing the seeds, at the end of August, the long horizontal rhizoma, which at its end is to bear the flowering stem of next season, begins to shoot forth, and from the axils of its scales produces a number of extremely short or rudimentary branchlets which are again branching and form short knobs on the rootstock. These branchlets bear a number of capillary leaves of the thickness of horsehair, and knotted like the ordinary leaves of this species, at this time, end of August, few in number, and only a few inches long. Towards the close of the season they increase in number and length, and seem to live through the winter wherever they are immersed deep enough to escape the frost. They attain their full development about May and June, when they are 2–3 feet long, and carpet the bottom of those streams, at the depth of 2–4 feet below the surface, with their dark green undulating masses, most beautiful to look at, but quite obnoxious to the proprietors of the mill-streams, the sluices of which they are apt to obstruct. These leaves decay about the period the plant begins to bloom. The beautiful specimens collected by Dr. Robbins for the Herbarium Normale (No. 53) exhibit them to perfection. The twist and bend of the stem of many of Dr. Robbins' flowering specimens is caused by the strong current in which they grew. The only thing approaching such submerged leaves, Mr. Parker has found in the Delaware above Philadelphia, where this plant grows "in shallow water, extending to the border of deep running water, the finest specimens growing at a depth of 3 or 4 feet." How does this species grow in stagnant ponds or swamps? It would be very desirable that collectors of *Junci* should pay more attention to the circumstances under which these plants occur, the process of their vegetation, the time of flowering and of maturity, and, of course, to the base of the stem and to the rootstock, which is too often a vain desideratum in herbarium specimens.

37. J. SUPINIFORMIS, n. sp.: foliis vernalibus e basi latiore subulatis capillaceis longissimis teretibus pallide virentibus natantibus evanescentibus; caule florifero erecto humili (digitali vel ultra) folia erecta teretia longiora gerente; panicula simplici; capitulis sub-5-floris; sepalis ovato-lanceolatis cuspidatis nervosis æqualibus seu externis paulo brevioribus inter se inæqualibus stamina 3 stigmataque paulo excedentibus; antheris oblongis filamento multo brevioribus; stylo per-brevi; capsula prismatica obtusa mucronata uniloculari calycem fere excedente; seminibus obovatis utrumque apiculatis.

Common in and around ponds near Mendocino City, California; May and June, *H. Bolander*, Cal. State Surv. 4767.—Mr. Bolander informs me that in spring these ponds are com-

pletely covered with the pale green capillary leaves of this species, 1–2 feet long. As the water recedes with the advancing dry season, the erect flowering stems begin to form, and a little later the vestiges of the decayed vernal leaves cover the remaining mud with grayish spiderweb-like filaments. The flowers are nearly 2 lines long, the (immature) capsule is prismatic with concave sides; the seeds, too imperfect to make out their sculpture, were 0.27–0.30 line long, large for the size of the plant.

This species is closely allied to *J. supinus* of Europe, whence the name, and appears to stand next to its var. *fluitans;* but that species has smaller flowers, with obtuse sepals, an obtuse capsule, and smaller seeds. These characters, however, do not seem to be quite constant, so that further examination of more complete specimens will be necessary.

38. J. Elliottii, Chapman Flor. South. St. 494: caulibus (1–2-pedalibus) cæspitosis erectis folia tenuia longe excedentibus; panicula composita vel decomposita subpatente; capitulis 3–9-floris globulosis; sepalis ovato-lanceolatis acutissimis æqualibus stamina 3 tertia parte superantibus capsulam late ovatam obtusam brevissime mucronulatam 1-locularem atrofuscam lucidam fere æquantibus; antheris linearibus filamento vix longioribus; ovario ovato obtuso stigmatibus subsessilibus subinclusis fere æquilongo; seminibus oblanceolatis fusiformibus utrinque attenuatis rufo-fuscis areis lævibus reticulatis.

From North Carolina, *Canby*, to South Carolina, *Ravenel*, *Beyrich* (distributed under the name *J. acuminatus*), Florida, *Chapman*, Hb. norm. 54, Alabama, *Sullivant*, and southern Mississippi, *E. Hilgard*.—Many slender stems spring from a short rhizoma, which bears numerous long fibrous rootlets (under water?); panicle usually 3–4 inches long, with a few principal branches; fruit-heads (from the broad, blunt capsules) obtuse, 2 or 2½ lines in diameter; flowers 1.0–1.2 lines long, greenish, turning brown; capsule usually very dark colored and shining, rarely paler; seeds easily distinguished by their dark color and slender form, mostly 0.23–0.27 line long and one-third as much in diameter; 5 or 6 ribs quite conspicuous. This is one of our earliest species, flowering in April and May. The slender growth, the small, obtuse, dark colored heads and dark seeds distinguish this plant at once, but whether Elliott's *J. acuminatus* is the same as this, as Chapman suggests, or whether it belongs to one of the forms of the next species, does not appear from his insufficient description.

39. J. acuminatus, Michx. 1, 192, non Gray, Man. nec auct. Amer. plur.: caulibus cæspitosis plerumque erectis; panicula effusa plus minus composita; capitulis pauci- vel multifloris pallidis sæpe demum stramineo-fuscatis; sepalis lanceolato-

subulatis acutissimis subæqualibus stamina 3 dimida seu tertia parte superantibus; antheris filamento plerumque brevioribus; stigmatibus subsessilibus ovario ovato obtuso seu rarius acutato sub-brevioribus inclusis; capsula prismatica mucronata seu acutata uniloculari sepala æquante seu excedente; seminibus minutis obovatis seu oblanceolatis utrumque acutis areis lineolatis reticulatis.

Var. *a. legitimus:* caulibus (1–2-pedalibus) erectis gracilioribus; panicula simplici composita vel decomposita patula; capitulis pluri-seu multi-(5–12–30–50)floris demum e fusco stramineis; floribus majoribus; sepalis æqualibus seu raro exterioribus paulo longioribus capsulam prismaticam obtusiusculam mucronatam fere æquantibus; antheris filamento multo brevioribus; ovario ovato acuto.—*J. acuminatus*, Michx. 1, 192; La Harpe, 136; Elliott, 1, 409? Kunth, 3, 335, non Auct. Am. plur.; *J. pallescens*, E. Mey. *Junc.* 31, non Lamarck; *J. paradoxus*, E. Mey. l. c. 30; La Harpe, 141; Kunth, 3, 341; non Auct. Am.; *J. fratermus*, Kunth, 3, 340; *J. debilis*, Gray l. c. ex parte; *J. Pondii*, Wood Bot. (1861) 724.

Var. *β. debilis:* caulibus (spithameis sesquipedalibus) debilibus erectis seu decumbentibus radicantibusve; capitulis pauci-(3–6)floris; floribus minoribus pallidis; capsula acuta breviter mucronata exserta.—*J. debilis*, Gray Man. ed. 2, 481.

Var. *γ. diffusissimus:* caulibus (bipedalibus ultra) erectis paniculæ ultradecompositæ ramis numerosissimis filiformibus elongatis; capitulis pauci-(3–7)floris pallidis; sepalis angustioribus stamina fere duplo superantibus; ovario acutato; capsula lineari-lanceolata acuta calyci fere duplo longiore.—*J. diffusissimus*, Buckley, Pl. Tex. l. c. p. 9.

Var. *δ. robustus:* caulibus elatis (2–4-pedalibus) erectis foliisque elongatis robustis; panicula ultradecomposita patula; capitulis pauci-(5–8)floris stramineo-fuscis; floribus minoribus; antheris filamenta æquantibus; capsula ovata obtusa mucronata fusca sepala acutissima paulo excedente.

All over the States, from Massachusetts southward to the Rio Grande, and westward to Missouri; var. *α* is the most common form found in the whole territory indicated; var. *β* I have only seen from New Jersey, *C. E. Smith;* Pennsylvania, *Schweinitz*, *Moser*, *Porter;* Ohio, *Lea;* Kentucky, *Short* (the original of Gray's *J. debilis*); Mississippi, *E. Hilgard*, and South Carolina, *Ravenel*, but it is probably more extensively distributed; var. *γ*, northwestern Texas, *Lincecum*, *Buckley;* var. *δ*, in the Mississippi Valley from Illinois, *Geyer*, *Mead*, *Vasey*, to Missouri! and to Louisiana, *J. Hale.*—All the forms of this species flower early in the season, according to latitude, from April to June, and shed their numerous seeds from May to July.

Through the kind liberality of Profs. Roeper of Rostock

and Decaisne of Paris I have now had the opportunity of examining and comparing fragments of Lamarck's original *J. pallescens* and Michaux's *J. acuminatus*. The former's name refers, as Prof. Roeper informs me, to two poor (*more suo*) specimens collected by Commerson near Buenos-Ayres; the heads are apparently 5-flowered; the flowers, not yet open, are similar to those of our plant, but are 6-androus and pedicelled. Lamarck gives North as well as South America as the habitat of his plant, but adds that his specimens are those above noticed; his reference to North America is evidently based on quotations from Pluk. Alm. t. 92, f. 9, and Moris. Hist. 3, sect. 8, t. 9. f. 5, which both represent rather something like *J. tenuis*. Meyer was undoubtedly misled by these references to North American localities to substitute Lamarck's to Michaux's name. La Harpe, p. 136, suggests, probably with more justice, that Commerson's plant is an immature *J. Dombeyanus*. Michaux's specimen, collected in South Carolina, is a rather small-flowered form of var. *legitimus*, such as often occur south-eastward (comp. Hb. norm. 58), with only 5 flowers in a head (Michaux says 3 flowers), the (unripe) capsule being about as long as the sepals. The other synonyms of the older authors have not given any less trouble, principally because both Meyer and Kunth have described their *J. paradoxus* and *J. fraternus* with outer sepals exceeding the inner ones (a very rare case in any form of *J. acuminatus*); and in the former the capsule was said to be longer, in the latter shorter, than the sepals; neither mentions the seeds. Having been able to examine a fragment of Kunth's plant, which had been sent from Boston by Boott, and is preserved in the Royal Herbarium at Berlin, I can most positively assert that it is a scanty-flowered form of what I have called var. *legitimus*, with the outer sepals very slightly exceeding the inner ones, and with a not fully ripe capsule about the length of the inner sepals. Meyer's *J. paradoxus* is more difficult to identify, because the original specimen does not exist in his herbarium; he had examined it, as a memorandum indicates, in Hb. Lehmann, to whom it was given by Willdenow under the name of *J. polycephalus*, and preserved only a drawing of it and a rough sketch of some details. There are, however, in the sheet superscribed by Meyer "*J. paradoxus*," ten dried specimens from different parts of the United States and Mexico, perhaps rather uncritically thrown together; flowers of only one of them have been sent to me, and they belong to the ordinary form of var. *legitimus*. The figure of the original type represents a plant with a decompound panicle about 4 inches high and as wide, with numerous few-flowered heads, and leafy excrescences from some of them; the other sketch shows an acute capsule exceeding the lanceolate-subulate sepals of *equal* length, and

the inside of a valve with a parietal placenta on the lower half. Meyer, therefore, had seen the ripe fruit, and could not have failed to see some seeds, unless all had fallen out; but as they did not differ from the common form of *Juncus* seeds, he did not mention their shape, which he would certainly have done, and would have placed the plant in his second section, *Marsippospermum*, had they been at all appendiculate, as they are in the plant with us heretofore taken for *J. paradoxus*. Besides this, the latter, which is enumerated here as *J. Canadensis*, var. *longecaudatus*, never has the inner sepals shorter, but almost always longer, than the outer ones, and has rarely, if ever, as far as I am informed, those leafy degenerations of the flower-heads so common in var. *legitimus*. La Harpe, who describes "*J. paradoxus*" from Pennsylvanian specimens, speaks of the sepals as being nearly equal to the capsule, and of the seeds as *ovoid*. Why both, Meyer as well as La Harpe, should have separated their *J. pallescens* or *acuminatus* from this *J. paradoxus* is not very clear; they have evidently seen very few or single specimens only, and seem to have laid too much stress on the slight difference in the length of the sepals.

The extreme forms of this variable plant might readily be taken for distinct species were the intermediate ones wanting. All the forms produce from a short rootstock few or many erect or somewhat ascending, rather weak (except in var. δ) terete or slightly compressed stems, rarely (except in var. γ and δ) over two feet, and sometimes less than one foot high. The bracts are broad, membranaceous, and (the outer ones at least) awned; heads and flowers are of different sizes, but the sepals always regularly lance-subulate and very acute or almost awned but not rigid, and, with rare exceptions, equal in length; only in some few specimens of var. *legitimus* I have seen the outer a little longer than the inner ones. Capsules as long as, or longer than, the sepals, pale green to straw-colored or light brownish, with parietal placentæ on the lower half of the valves. Seeds obovate or oblanceolate, acute or apiculate at both ends, 0.20–0.25 line long, the length being equal to about $2\frac{1}{2}$ diameters, of a yellowish or light brown color and apparently semi-transparent, neatly reticuted, and 6 or 7 ribs visible on one side.

Var. *a. legitimus* is the most variable of all the forms of this species, but is always readily recognized by the larger flowers, 1.5–2.0 lines long, and the ovate-prismatic obtusish mucronate capsule of the length of the sepals. Stems scarcely ever over 2 feet high; panicle, as well as heads, extremely variable, the former apparently more compound and the latter fewer-flowered north and eastward, while some Illinois (*E. Hall*, Hb. n. 55) and Texas specimens ("Hog bed prairies" on the Guadaloupe, *Wright*, Guadaloupe to Matamoras,

Berlandier 1571 and 2556 in part) have few (3–8) large globose 20–50-flowered heads. Capsule rarely exceeding the calyx, and then approaching var. β. Seeds variable within the limits of the species, slender, or sometimes thick. Hb. n. 56 is a taller and 57 a slenderer form with fewer flowered heads, from Michigan, *Bigelow;* 58 and 59 are what Meyer named *J. paradoxus*, the former a smaller-flowered form from S. Carolina, *Ravenel*, the latter a larger-flowered one from Delaware, *Commons*.

Var. β. *debilis* is distinguished by the mostly very weak stem, ½–1½ feet high, sometimes reclining, and even decumbent and rooting; panicle loose-flowered, 3–6 inches long; flowers 1.2–1.5 lines long; capsule very pale, more or less protruding beyond the calyx; seeds the smallest in the species. A rather small but rigid form comes from South Carolina, Hb. n. 60, *Ravenel*, and a similar autumnal one, in which the heads by renewed vegetation of their axis degenerate into spikes, has been sent by the same botanist, ib. 61.

Var. γ. *diffusissimus*, stouter, 2–2½ feet high, with a panicle 8 or 9 inches long and fully as wide; fruit-heads 5 lines in diameter; flowers 1½ lines, or, with the straw-colored radiating capsules, fully 2½ lines long; seeds as in last.

Var. δ. *robustus* is a very different looking plant, which in the hot Nelumbium swamps of the Mississippi bottoms grows even 4 feet high, with a stem 3 lines in diameter and leaves in proportion, which, however, do not reach beyond the base of the inflorescence; panicle 6–10 inches long and a little less across, with fruit-heads only 2 lines in diameter; flowers smaller than in the other forms, 1.1–1.2 lines long, and capsules more obtuse than in the others, with a short mucro; seeds among the larger ones.—The specimens distributed in Hb. n. 62 are, owing to the very dry season, not so well developed as the plant is often seen, nor did the fruit mature at all in that or the following year. It is an interesting fact observed by me for many years, that, if not in the whole Mississippi Valley, at least in this neighborhood, our ponds and lakes become lower every year, their rich vegetation is becoming extinct, and many have dried up altogether. Our beautiful Nelumbium, which twenty and ten years ago was an ornament to many sheets of water on hill as well as lowland in this vicinity, hiding them under their broad velvety leaves, and from the end of June to the middle of August dotting them with their splendid cream-white flowers, is fast disappearing in consequence of the retrocession of those waters, and with it its companions the Sagittariæ, the Spargania, the Junci, the Scirpi, the Zizania, and many of their minor attendants. But what botany and beauty loses, cultivation gains, and, above all, the health of the neighborhood.

40. J. BRACHYCARPUS, n. sp.: caulibus e rhizomate crasso horizontali paucis erectis (1–2½-pedalibus) rigidis teretibus; panicula e capitulis globosis multi-(30–50–100)-floris paucis seu pluribus simplice seu composita conferta; sepalis lanceolato-subulatis, interioribus quam exteriora multo brevioribus stamina 3 capsulamque triangulato ovatam acuminato-rostratam unilocularem æquantibus seu paulo superantibus; antheris lineari-oblongis filamento multo brevioribus; stigmatibus subsessilibus ovarium ovatum acuminatum fere æquantibus inclusis; seminibus parvis oblanceolatis obovatisve utrumque acutatis areis læviusculis reticulatis.—*J. cryptocarpus*, Bebb in litt.

In the Mississippi Valley from central Ohio, *Sullivant*, Michigan, *Folwell*, *Bigelow*, Hb. n. 74, and Illinois, *Bebb*, *Hall*, Hb. n. 63, to Missouri! Kentucky, *Short*, Mississippi, *Hilgard*, Louisiana, *Hale*, and Texas, *Berlandier* 309, 313, 1569, 1573, and 2556 in part, *Lindheimer;* also, if the locality is correctly reported, near Charleston, S. C., *Beyrich* (distributed as *J. echinatus*). — Flowers in May and June, in Texas in April. — On one side this species is allied to the large-headed forms of *J. acuminatus*, and on the other much more closely to *J. scirpoides*, with both of which it has been confounded; it has the rhizoma and the inflorescence of the latter, but its very short inner sepals and short capsule at once distinguish it from either.—Stems from 8–10 inches (seen mostly in Texas specimens) to 2–2½ feet high, rather rigid; heads 4–5 lines in diameter, single or 2–3 together, or more commonly 5–8, or even 10, in a short (1–2 inches long) contracted panicle; flowers 1.8–2.0, and capsule 1.2, lines long, so that, as Mr. Bebb remarks, at maturity the arid sepals, protruding over the almost hidden capsule, give the plant an appearance of sterility. Filaments twice or three times as long as the anthers; seeds 0.20–0.22 line long, in shape like those of the last species, but the areæ are scarcely lineolate, the ribs, however, are crenulate and sometimes short, transverse lines extend from them into the area. Among Lindheimer's Texan specimens are some, the heads of which are degenerated into leafy excrescences.

41. J. SCIRPOIDES, Lamarck, Enc. 3, 267 (E. Meyer in Linn. 3, 370): caulibus (1–4-pedalibus) e rhizomate horizontali crasso albido rigidis strictis (seu raro decumbentibus) foliosis; capitulis globosis multifloris paucis seu pluribus; sepalis subulatis sæpius aristato-acutissimis demum rigidis spinescentibus; staminibus 3; capsula triangulato-pyramidata subulata uniloculari; seminibus oblanceolatis obovatisve utrumque acute apiculatis areis sublævibus reticulatis.—*J. polycephalus*, Michx. Fl. 1, 192; Pursh, Fl. 1, 237; Mey. Junc. 33.

Var. *a. macrostemon:* caulibus (1–2-pedalibus) foliisque

teretibus rigidis strictis; capitulis paucioribus minoribus in paniculam strictam dispositis; staminibus sepala fere æquantibus, antheris lineari-oblongis filamento pluries (quater seu ultra) brevioribus; capsula calyci æquilonga seu rarius exserta; seminibus minoribus.—*J. scirpoides*, Chap. 494 in part.

A. *macrostylus:* sepalis æqualibus seu sæpius exterioribus brevioribus; stylo elongato, capsula plerumque lageniformi.—*J. macrostemon*, Gay, in La Harpe, 140.

B. *brachystylus:* sepalis æqualibus seu plerumque exterioribus, longioribus, stylo perbrevi.—*J. echinatus*, Muhl. Gram. 207? *J. scirpoides*, Lamarck in Herb.! Gray, Man. ed. 2, 481.

Var. β. *echinatus:* caulibus (1½–3-pedalibus) foliisque teretibus rigidis strictis; capitulis paucioribus majoribus in paniculam simplicem dispositis; sepalis exterioribus plerumque longioribus stamina dimidia seu tertia parte superantibus; antheris filamento (duplo triplove) brevioribus; stylis abbreviatis; capsula sepalis æquilonga seu rarius exserta; seminibus minoribus.—*J. echinatus*, Ell. Sk. 1, 410; *J. megacephalus*, Curtis, in Bost. Jour. N. H. 1, 132; *J. polycephalus, a.* La Harpe, 140; *J. scirpoides*, Chap. l. c. in part.

Var. γ. *polycephalus:* caulibus (2–4-pedalibus) compressis erectis seu flaccidis hinc decumbentibus; foliis a latere compressis gladiatis; panicula effusa decomposita et ultra; capitulis majoribus; stylis abbreviatis; capsula exserta.—*J. polycephalus*, Ell. 1, 409; Chapm. 494; *J. polycephalus, a.* Michx. l. c.; Pursh, l. c.; Mey. Junc. 33; *J. polycephalus, γ.* La Harpe, 140.

A. *minor:* caulibus capitulisque paulo minoribus; sepalis æqualibus trinerviis; antheris filamentum fere æquantibus; seminibus majoribus fusiformibus.

B. *major:* caulibus capitulisque majoribus sepalis uninerviis exterioribus interiora tenuia superantibus; antheris filamento brevioribus; seminibus obovatis abrupte apiculatis.

A southern species, which extends northeastward as far as Pennsylvania and New Jersey. Var. *a.* A. I have only seen from South Carolina, Hb. n. 67 (the form with lobed heads), to Florida, Alabama and Texas; *a.* B. is distributed over the whole range of the species, from New Jersey and Pennsylvania, Hb. n. 65, to South Carolina, Hb. n. 66, Arkansas and Texas. Var. β. has been found from Maryland to Florida, Hb. n. 68 and Texas; Var. γ. A. from North Carolina to Florida, Hb. n. 69, and var. γ. B. from the same States westward to Louisiana, Arkansas and Texas. There must be some error in La Harpe's statement that La Pylaie found *J. macrostemon* in Newfoundland; perhaps he took the large-headed form of *J. nodosus* for it.—It flowers, according to latitude, from June to August.

I comprise under the name of *J. scirpoides* a number of forms, several of which have often been taken for distinct

species. Michaux, who no doubt had seen a great deal of it in the south-eastern States, had united all under his *J. polycephalus*, in which he was followed by Pursh as well as by Meyer; but the earlier name of Lamarck must take precedence, though it seems to refer only to a single form, a specimen of which, brought by Frazer from South Carolina, is still preserved in his herbarium, now in the hands of Prof. J. Roeper of Rostock. This proves to be var. *macrostemon* (the form with longer exterior sepals), as has already been stated by Meyer (Linn. 3, 370). The older authors appear to have confounded it with *J. nodosus*, which latter Michaux does not seem to have known or distinguished, and which, on the other hand, is taken by Hooker in Flor. Bor. Am. for *J. polycephalus*.

All the forms of this species have compact, globose, mostly greenish heads, turning straw-color or light brown at maturity, on rigid or stout stems, rising, at least in var. *α* and *β*, from thick white horizontal rhizomas; those of var. *γ* I have never seen in herbarium specimens; sheaths of the leaves, especially in *α* and *β*, loose and open; stamens 3, very rarely, in var. *α*, 4 or 5 in number; seeds, though differing much in form and size (from 0.2 to over 0.3 line long, and from an elongate fusiform to a thick ovate shape), with 5 or 6, very rarely 7, ribs on one side, and smooth or delicately marked areæ; these marks consist of one or a few perpendicular lines, sometimes crossed by a couple of horizontal ones.—Our southern botanists will have to find out whether one or the other of these forms may not justly claim to be considered as a distinct species.

Var. *α* is readily recognized by its wiry stem 1–2 feet high, its strictly erect panicle of a few (5–9, rarely single) small heads, 3½–4 lines in diameter, and composed of 15–30–40 flowers,* the stamens of which are as long as the sepals, the small anthers often protruding from between their tips; flowers 1¼–1½ lines long; seeds 0.23–0.28 line long, their length being equal to 2–2½ diameters. The form with long protruding styles has in flower a very curious aspect; in fruit it is often of a deeper brown than any other variety, and its capsules are not regularly subulate, as we find them in all other forms of this species, but oblong and rostrate, almost bottle-shaped. Another peculiarity of it is, that its heads are often lobed, as already remarked by Dr. Chapman, i. e. composed of a number (3–5–7) of smaller heads, the axillary productions of the lowest bracts of the primary head. Sometimes the panicles become larger, 6 inches or more in length, and composed of numerous heads; in some southern, especially Texan, speci-

* Muhlenberg describes his *J. echinatus* with 9-flowered heads, and Lamarck his *J. scirpoides* with heads bearing 12–18 flowers.

mens I find the inflorescence more spreading, and with somewhat larger heads, so that thus the transition to the following varieties seems to be given.

Var. β is 1–3 feet high, and stouter, and bears its larger heads in an almost umbel-shaped, more compact panicle; heads 5–6 lines in diameter, consisting of 50–90 flowers, each of which is 1¾–2 lines long; seeds 0.22–0.25 line long, slender, their lengths being equal to 3 diameters. The inflorescence is sometimes looser and more compound, making a transition to the next.

Var. γ is a very different looking plant, with a compressed, tall, often inclined and even decumbent stem, which is said to become 4 feet long; leaves laterally compressed, already described by Elliott as *gladiate*, 3–6 lines wide; panicle spreading, 8–12 or 15 inches long and about as wide, with distant, sometimes one-sided (usually called *sessile*) heads, i. e. heads from the base of which a long axillary peduncle springs, which bears a second head that often behaves in the same manner. So far both forms of this variety agree, but in the flowers and in the seeds they appear very different, and may eventually have to be separated, though our best southern botanists do not distinguish them, and seem to agree in the view that it is the rich marshy soil of their ricefields, and similar localities, which produces these "overgrown" forms.—The fruit-heads of the smaller form have a diameter of 5–6 lines, and are composed of 30 or 40 to 70 or 80 flowers; flowers, i. e. calyx, 2–2½ lines long, sepals about equal in length, and exterior and interior ones not more different in structure than is usually the case; anthers longer than in any other variety of our species, and equal to the filament; seeds the longest and most slender of all the forms, 0.30–0.33 line long, the length equal to 3 or 3½ diameters.—The subvariety *major* has fruit-heads of 5–7 lines in diameter, the long pointed capsules radiating conspicuously in all directions; 20–50 or 60 flowers, 2¼–2½ lines long, in each head; sepals very unequal in length, as well as in texture, the exterior ones triangular dagger-shaped, and at maturity indurated; the interior ones much shorter, and more or less membranaceous; seeds ovate or almost globose-ovate, obtuse, very abruptly or sometimes scarcely apiculate, 0.20–0.23 line long, the length being equal to 1½ or less than 2 diameters.

42. J. Bolanderi, n. sp.: caulibus (bipedalibus ultra) gracilibus rectis compressis; foliorum teretiusculorum striatorum vaginis longe biauriculatis; capitulis multi-(30–50)-floris singulis seu paucis in glomerulum congestis seu breviter pedunculatis; florum (fuscorum) sessilium sepalis linearilanceolatis subulatis æquilongis stamina 3 quarta parte superantibus capsulam clavato-turbinatam obtusam mucronatam

unilocularem æquantibus; filamentis anthera oblongo-lineari apiculata bis terve longioribus; seminibus obovatis apiculato-acutatis areis lineolatis reticulatis.

Swamps near Mendocino City, California, discovered in October, 1865, by *H. N. Bolander*, and named for him, one of the acutest and most zealous explorers of Californian Botany. Rhizoma not seen; flattened stems very slender, terete leaves strongly knotted; mature heads 4–5 lines in diameter, brown, shining, single, or 2, or, usually, 3–5 together, either sessile and crowded together into a large cluster, or, some of them, peduncled; flowers 2 lines long, with very narrow and sharp pointed sepals, and very slender stamens; shape of capsule quite peculiar; seeds 0.25 line long, with about 8 ribs visible. The flattened stems and the brown heads assimilate this species to the Californian *Ensifolii*, but the rounded and strongly knotted leaves and the sessile flowers seem to separate it from them and place it with *J. scirpoides* and its allies.

43. J. NODOSUS, Lin. Sp. Pl., ed. 2, 1, 466, excl. syn.; Rostk. Mon. 38, t. 2, f. 2, excl. syn. Torr. Fl. N. Y. 2, 326, excl. var. 2; Gray, Man. ed. 2, 482: caulibus teretibus erectis e basi stolones tuberiferos emittentibus; paniculæ plerumque subsimplicis capitulis pluri vel multifloris; sepalis lanceolato-linearibus subulatis stamina 6 fere duplo superantibus capsulam pyramidato-rostratam unilocularem æquantibus seu plerumque ea brevioribus; seminibus ovatis abrupte apiculatis lineolato-reticulatis.—*J. Rostkovii*, Mey. Junc. 26; La Harpe, Mon. 133; Kunth, l. c. 332; *J. polycephalus*, Hook. Fl. Bor. Am. 2, 190.

Var. *α. genuinus*, caule humiliore (spithameo ultrapedali, rarissime elatiori) foliisque tenuibus; spatha erecta paniculam subsimplicem coarctatam (raro capitulum singulum) superante; capitulis minoribus pluri-(8–20)floris; floribus minoribus fuscatis; sepalis lanceolatis æqualibus seu exterioribus paulo brevioribus; antheris oblongis seu oblongo linearibus plerumque apiculatis filamento brevioribus; ovario ovato stylo brevissimo coronato; capsula ovato-lanceolata rostrata plus minus exserta.

Var. *β. Texanus:* caule elatiore (pedali bipedali) foliisque tenuibus; spatha patente paniculam plerumque compositam decompositamve fere æquante; capitulis majoribus multi-(15–40)floris; floribus majoribus demum stramineis; sepalis lanceolato-subulatis exterioribus brevioribus; antheris linearibus obtusis filamento (hinc duplo) longioribus; ovario lanceolato in stylum longiorem sensim abeunte; capsula pyramidato-lanceolata subulata exserta.

Var. *γ. megacephalus*, Torr. l. c.: caule elatiore (pedali tripedali) foliisque robustis; spatha erecta seu paulo deflexa foliove summo paniculam subsimplicem coarctatam sæpius

superante; capitulis magnis densissime multi-(30–80)floris; floribus majoribus virescentibus demum stramineis; sepalis lanceolato-subulatis exterioribus longioribus; antheris linearibus filamento paulo brevioribus; ovario lanceolato in stylum brevem sensim abeunte; capsula pyramidato-subulata vix exserta.—*J. megacephalus*, Wood, Bot. 724, non Curtis.

This species takes a much wider geographical range than the last, including the whole of North America north of Mexico, with the exclusion of the south-eastern States; but the different forms occupy different geographical regions. Var. *a.* is found throughout British North America from Canada and the Hudson Bay regions to the Rocky Mountains and the North-west coast, and extends southward to Pennsylvania, *Porter*, Hb. n. 70, Ohio, *Lapham*, Michigan, *Bigelow*, Hb. n. 71, and Wisconsin, *Lapham*, *Hale;* I have seen no specimens from further south, though the older authors credit it to Virginia and Carolina, quoting, among others, Bosc as their authority. Var. β has been solely found in Western Texas, *Lindheimer*, 545, *Wright*, *Buckley*. Var. γ meets *a* on Lake Ontario, where also *J. alpinus* and *articulatus* join, and extends from thence westward to Michigan, *Bigelow*, Hb. n. 74, and southwestward to Illinois, Missouri, the northern Red River, *Hubbard*, the Saskatchawan, *Bourgeau*, the Yellowstone, *Hayden*, Colorado, *Parry*, Hb. n. 75 (a dwarfed form), New Mexico, *Fendler*, 849 *Wright*, 696 & 1926, Texas, *Lindheimer*, 546, and others; and to Arizona, *Coues & Palmer*, and California, *Coulter*, 809. It flowers from July to August.

Our plant is very closely allied to the last one, and is often confounded with it; but the number of stamens and the markings of the seeds will readily distinguish any of the forms which may be mistaken for one another, e. g. *J. scirpoides*, β *echinatus*, and *J. nodosus*, γ *megacephalus;* besides, the slender stolons which terminate in a chain of small bulbs, probably the only part that sustains the life of the plant during winter, are quite characteristic of all the forms of this species. Another peculiarity of var. β and γ is the direction of the leaves, especially the upper ones, which are patulous, making a very distinct angle with their sheathing base, while in var. *a* the leaves are erect, forming an almost straight continuation of the sheath. Var. *a* and more rarely var. γ exhibit sometimes that degeneration of the heads into bunches of sheaths or leaves which has been spoken of in another place. The seeds are 0.22–0.27 line long, the length being nearly equal to 2, rarely to $2\frac{1}{3}$ diameters; commonly 8 ribs are visible on one side.

The northern form, var. *a*, is the genuine *J. nodosus* of Linnæus, who described it from specimens sent by Kalm (most probably from Canada), as Prof. Gray ascertained in the Linnæan herbarium itself; he informs me that "Linnæus'

reference to Gronov. Virg. 15 [leg. 152] is a mistake, in copying from Gronovius of *Gramen junceum elatius pericarpiis ovatis Americanum*, Pluk. alm. That this is not the type of *J. nodosus* is clear, because it does not, like all other Gronovian plants, appear in the first edition of Spec. Plant. Linnæus' annotations prove that he was considering some plant in his herbarium, and not a mere quotation." The figure of Rostkovius is a very good representation of the ordinary appearance of this variety.—It is by far the slenderest form, usually from 8–12 or 15 inches high, with 2–5 or 8 brown heads in a rather compact and simple or slightly compound panicle; in the Rocky Mountains a dwarf form occurs, with a filiform stem 3–5 inches high, bearing a single few-flowered head (*J. polycephalus*, γ, Hook. l. c.); a similar variety was collected on the mountains of Vermont by *H. Mann*, Hb. n. 72; *Judge Clinton* and *Dr. Bigelow*, Hb. n. 73, send from the shores of the northern lakes a taller form, 2–3 feet high, with a more compound lighter colored panicle; and this makes a transition to one which Dr. Vasey has sent from the northern border of Illinois, a stout, large (nearly 2 feet high) green-headed plant, with a decompound panicle of at least 30 greenish heads, each composed of 25–35 flowers. This latter is an interesting form, as it connects all three varieties.—The heads of the genuine *J. nodosus* are 3½–4 lines in diameter, and show a deeper brown color than any of the other varieties; the flowers are 1½–2 lines long, and the capsule, which is usually rostrate from an oblong body and not regularly subulate, in most instances considerably exceeds the sepals. The seeds are, as in all other forms of this species, ovate or obovate, abruptly apiculate, and prettily reticulated with very distinct cross-lineolation, 0.22–0.27 line long, their diameter being equal to about one-half their length, or, in some forms with slender seeds, much less.

Var. β is usually a taller plant, 12–20 inches high, but quite slender; the compound or decompound rather lax panicle is 2–4 inches long, and the echinate fruit-heads have a diameter of 5 or 6 lines. Flowers 2½ lines long; obtuse anthers often twice as long as the filaments; seeds usually a little smaller than in the last, 0.22–0.24 line long.

Var. γ is a stouter plant, 1–2½ feet high, with the largest heads of any *Juncus* known to me, in fruit 6–8 lines in diameter, in a rather compact panicle; seeds like those of the last. The Texan variety and Dr. Vasey's specimens, mentioned above, unite this with the genuine *J. nodosus*, from which I cannot separate it, though looking so very distinct.

44. J. Canadensis, J. Gay in La Harpe, Mon. 134; Kunth, l. c. 333; caulibus cæspitosis teretibus lævibus; paniculæ capitulis pauci-multifloris; sepalis lineari-lanceolatis plerumque

acutis, exterioribus brevioribus stamina 3 vix seu paulo superantibus; antheris oblongo-linearibus filamento brevioribus; ovario in stylum brevem attenuato, stigmatibus vix seu breviter exsertis; capsula triangulato-prismatica uniloculari plerumque exserta; seminibus oblongis seu oblongo-linearibus multi-costatis plus minus caudatis.

* Formæ capitulis minoribus paucifloris.

Var. *a. coarctatus:* caulibus humilioribus ($\frac{1}{2}$–1$\frac{1}{2}$-pedalibus) erectis; paniculæ minoris coarctatæ ramis erectis; florum minorum sepalis acutis seu raro obtusiusculis; antheris oblongis filamento duplo brevioribus; capsula castanea acutata longius exserta; seminibus oblongis lineolato-multicostatis, appendicibus diametrum fere æquantibus.—*J. Canadensis*, β. Gay, l. c.; *J. acuminatus*, Torr. N. Y. 2, 327; Gray, l. c. 481; Chap. Fl. 464, et Auct. Am. plur. non Michx.

Var. *β. brachycephalus:* caulibus elatioribus (1$\frac{1}{2}$–2$\frac{1}{2}$-pedalibus) gracilibus erectis seu descendentibus; paniculæ majoris effusæ ramis patulis; florum minorum sepalis plerumque obtusis; antheris linearibus filamento brevioribus; capsula e stramineo fuscata obtusiuscula mucronata breviter exserta seminibus ut in var. *a.*

* * Formæ capitulis majoribus plurifloris.

Var. *γ. subcaudatus:* caulibus (1–2$\frac{1}{2}$-pedalibus) gracilibus erectis seu decumbentibus; paniculæ effusæ ramis patulis sæpe horizontalibus; capitulis pluri-(8-20)floris; florum majorum sepalis acutissimis; antheris oblongo-linearibus filamento multo brevioribus; capsulis demum stramineis plerumque acutatis exsertis rarius mucronatis subexsertis; seminibus oblongis reticulato-multicostatis in appendices perbreves attenuatis.

Var. *δ. longecaudatus:* caulibus (1$\frac{1}{2}$–3-pedalibus) erectis robustis rigidis; paniculæ abbreviatæ seu patulæ capitulis pluri-multi-(5–8–20–50–90)floris; florum majorum sepalis acutis seu rarissime obtusiusculis; antheris oblongis sæpe mucronatis filamento plerumque duplo brevioribus; capsulis prismaticis obtusis mucronatis seu rarius acutatis sæpe fuscatis sepala excedentibus seu rarissime æquantibus; seminibus oblongis seu oblongo-linearibus lineolato-multicostatis, appendicibus diametro longioribus.—*J. Canadensis, a.* Gay, l. c.; *J. polycephalus, β. paradoxus*, Torr., N. Y. 2, 327: *J. paradoxus*, Gray, l. c.; Chapm. l. c. et Auct. Am. plur., non Meyer.*

This species inhabits the eastern parts of North America and extends westward in the region of the Great Lakes to the Upper Mississippi and down to central Illinois, and again in the Gulf States to Louisiana, leaving out the

* This arrangement of the varieties differs somewhat from that previously adopted by me on p. 436, and in some herbaria labelled by me. No confusion will arise from this if the reader will only substitute "*brachycephalus*" for *brevicaudatus patulus.*

central States of the Mississippi Valley, to which it seems to be a stranger. It flowers in July and August, when *J. acuminatus*, with which it might be confounded, has already shed its seeds.—Var. *α* is decidedly the most northern form of this species, which extends from the northeastern States to Canada and the Lake Superior region, Hb. n. 76 & 77, and southward to Pennsylvania, where Prof. Porter finds it in the neighborhood of Lancaster; Dr. Chapman gives Georgia as the southern limit of "*J. acuminatus*," but I have seen no specimens from those southern parts. —Var. *β* has been observed from Pennsylvania, *Porter*, to western New York, *Gray*, *Sartwell*, *Vasey*, *Clinton*, Central Ohio, *Sullivant*, Central Illinois, *Hall*, *Brendel*, Michigan, *Bigelow*, Hb. n. 79, and Wisconsin, *Lapham*.—Var. *γ* is a form of the Atlantic States, found from Connecticut, *Eaton*, to New Jersey and Pennsylvania, *Durand*, *Smith*, Hb. n. 81, *Leidy*, *Porter*, Hb. n. 80, Delaware, *Commons*, Hb. n. 82, District of Columbia, *Bebb*, South Carolina, *Nuttall*, and Georgia, *Beyrich* (distributed by him under the name of *J. acuminatus*).—Var. *δ* is the most common of all the forms, extending over the whole region, with the exception, perhaps, of its north-eastern extremity. I have not seen any specimens from Canada, or from the States north of Massachusetts. The Herb. norm. contains different forms of this variety from Michigan 84, Pennsylvania 83, Maryland 88, and South Carolina 85, 86 and 87.

The different forms of this intricate species are as wide apart in habit, as well as in artificial characters, as they possibly can be, but are connected by insensible transitions, so that even the different varieties cannot always be kept clearly distinct. Its synonymy is in some confusion. It is quite impossible that specimens of so wide-spread and so easily accessible a species should not have been obtained by collectors long since, and we do indeed find such among Michaux's (La Harpe, l. c.) and among Schweinitz's plants, and no doubt in many other old herbaria; but, somehow or other, its striking diagnostic characters were overlooked, and it was thrown together with other species, such as the similar looking *J. acuminatus*, especially its var. *legitimus*, under the name of *J. polycephalus* or *J. verticillatus* (lege *subverticillatus*).—This and the following two species are well distinguished from all the other articulate ones by their tailed seeds and by the proportions of their usually strongly nerved sepals, the inner of which always exceed the outer ones. From its two allies it is distinguished principally by the shape and proportion of its capsule, and the smaller and differently shaped seeds.

Varr. *α* and *β* are distinguished from the others by their small, usually 3–4-flowered, heads, smaller flowers, which are 1¼–1½ and only in Lake Superior specimens of *α* 1¾ lines long,

and the form of the smaller seeds. These seeds are 0.25–0.33 line long, 2½ diameters being equal to the length; appendages about equal to the diameter, so that the whole seed has a length of 0.40–0.60 line; 7–9 ribs visible, connected by delicate cross-lines.

Var. *a* is readily known by its low stature, rarely over a foot high, erect, dark colored panicle (1–4 inches long and ¾–1½ inches wide) and elongated capsules, and therefore longer fruit-heads; the sepals are usually acute, but in some forms from Pennsylvania and from New Hampshire I have found them obtuse. American botanists have usually taken this form for *J. acuminatus*, Michx.; but Michaux's plant is very different and, moreover, comes from South Carolina, while the present variety is, I believe, not found south of Pennsylvania. Prof. Porter gets in the mountains of that State a low form with more patulous lighter colored panicles, and more obtuse sepals, Hb. n. 78, which seems to form a transition to the next variety.

Var. *β* stands in habit and stature nearest to var. *γ*, but its small, short heads, obtuse sepals and short capsules distinguish it at once from that and from var. *a*; our botanists have sometimes confounded it with *J. debilis* or with *J. articulatus*, from both of which however the characters enumerated readily distinguish it. Stem 1½–2½ feet high; panicle 4–9 inches long and proportionately wide. Mr. C. E. Smith gets a form at Tinnicum, near Philadelphia, which unites this with var. *γ*, having the seeds of this, but the greater number of flowers (10–12), the larger heads, and the pointed sepals, of the other.

Var. *γ* is a rather rare plant and does not seem to have attracted the attention of botanists, though it had been collected especially about Philadelphia and in New Jersey, until Mr. Bebb of Washington and Mr. Smith of Philadelphia studied it with a great deal of attention; the shortness of the appendages had induced some to place it away from its close alliances and with or near *J. acuminatus*, but I cannot entertain any doubt but that it is so closely allied to var. *δ* that it can barely be kept apart from it, the length of the appendages being quite variable even in seeds from the same capsule. The whole plant, however, is more delicate, lighter green, the stem weak, and more usually decumbent, the panicle very loose, commonly with long and often horizontally-spreading slender branches; heads pale, 8–15–20-flowered; flowers as large as in the next, 1½–2 lines long; sepals always subulate and very acute, and often only 1-nerved; capsule more commonly acute or acutate, as long or mostly longer than the sepals; seeds 0.25–0.36 line long, thicker than in the next variety, the length being equal to 2–2½ diameters; seed with appendages 0.33–0.50 or very rarely 0.60 line long; appendages less than

the diameter of the seed, often only half as long; 7–8 ribs visible, usually very distinct, with cross-striation and an approach to reticulation.—A slender form is distributed in Hb. n. 80 and 81, a more rigid one is n. 82, but both run together.

Var. δ is the most polymorphous of all the forms of this species; it is stouter, taller and more rigid than the other varieties, and thus approaches more nearly to the following species. The panicle 3–6, or sometimes as much as 9 or 10, inches long, and 2–5–7 inches wide, with somewhat spreading but rarely horizontal rays, is either much branched and bears smaller (5–8–20-flowered) but more numerous heads, or it is more simple, with larger (30–40 and in some Delaware specimens even 80 or 90-flowered) and fewer heads; it is usually loose, but sometimes quite compact; specimens from South Carolina, Hb. norm. 85, have large green heads in a decompound panicle. Flowers 1½–2 lines long, greenish, at last with the capsules light brown; sepals generally 1–3 or sometimes 5-nerved, very acute, or rarely somewhat obtusish, usually quite unequal, or, as an exception, nearly equal in length; capsule prismatic, and usually obtusish and mucronate, as long as or mostly longer than the sepals, sometimes acutate and elongate. Seeds slender, and either large with shorter appendages, or smaller and thinner and with longer tails; the former are 0.30–0.46 line long, length equal to 2½ diameters, with the appendages 0.60–1.00 line long; the more slender seeds are of the same total length, but the body of the seed is a little shorter (0.25–0.35 line long) and its length is equal to nearly 3 diameters; 8–10 or 15 ribs or striæ are visible on one side of the seed.—A curious form with branched heads, the single branches being elongated into spikes, was found by A. Commons near Salisbury, Maryland (see p. 427). Mr. Ravenel has collected this species in South Carolina with often more than 3 stamens; Hb. n. 87.—This variety is the plant which by most American botanists has been taken for Meyer's *J. paradoxus;* but I have shown above (p. 462) that Meyer's plant, *sepalis "exterioribus longioribus,"* must be what I have designated as *J. acuminatus*, var. *legitimus*, and cannot have been meant for our plant, the exterior sepals of which are *shorter*. Meyer's name was not given in reference to the curious seeds, but to the frequent foliaceous excrescences of his plant, which seem to be quite rare, if not unknown, in the present species.

45. J. CAUDATUS, Chapm. Fl. S. St. 495: caulibus (2–3-pedalibus) cæspitosis teretibus foliisque rigidis lævibus; paniculæ compositæ seu decompositæ ramis suberectis; capitulis pauci-(2–5)floris; sepalis lanceolatis 3–5 nerviis, exterioribus brevibus acutis stamina 3–6 æquantibus, interioribus subulatis

longioribus; ovario lineari-lanceolato in stylum perbrevem sensim abeunte, stigmatibus exsertis; capsula obtuse triangulata pyramidata acutata atro-rubente lucida semitriloculari longe exserta; seminibus lineari-oblongis multo-lineatis longe caudatis.—*J. erythrocarpus*, Chapm. olim in sched.

South-eastern and southern States, from South Carolina, *Curtis*, *Ravenel*, Hb. n. 89, to Florida, *Chapman*, Hb. n. 90, Alabama, *Bigelow*, and Louisiana, *Hale;* fl. Sept. & fr. Oct.—Similar to the next but with much smaller flowers, long protruding pyramidal capsule, slender stamens inconstant in number and larger seeds. Rigid cespitose stems "from a thick and creeping rhizoma" (Chapman); panicles in most of the specimens before me 2–6 inches in length and quite contracted, the principal branch of the panicle being often strictly erect and quite elongated,—in others more open; fruit-heads 2–4 lines in diameter, with 2–4 or 5 flowers; flowers $1\frac{3}{4}$ lines long, with very unequal strongly nerved sepals; capsule much longer, sometimes twice as long as flowers, regularly pyramidal from an oval base, deep red brown or almost black. The number of stamens is quite variable, but more frequently 3 than 6; in 40 flowers of eight different specimens, from all the localities mentioned above, I have found only 4 with 6, 9 with 5, 11 with 4, and 16 with 3 stamens, and in no instance did all the flowers of one plant exhibit the same number of stamens. Seeds, without the appendages, 0.45–0.50 line long, their length being equal to $2\frac{1}{2}$ or $2\frac{3}{4}$ diameters; appendages straw-colored or white, upper one mostly as long or longer than the seed, lower one stouter and shorter, as is usually the case in the appendages of *Juncus* seeds; whole seeds with the tails $1–1\frac{1}{4}$ lines long; striæ of seed very numerous and close.—This may possibly be the same as *J. trigonocarpus*, Steud. Glum. 2, p. 308, of which I have not been able to obtain a specimen or a satisfactory description.

46. J. ASPER, n. sp.: caulibus (bipedalibus et ultra) cæspitosis teretibus cum foliis papilloso-asperatis; paniculæ compositæ seu decompositæ ramis erecto-patulis; capitulis pauci-(2–6)floris; sepalis late lanceolato-subulatis rigidis multinerviis lævibus, interioribus longioribus stamina 6 duplo superantibus; antheris late linearibus filamentum late subulatum fere æquantibus; ovario lanceolato in stylum eo breviorem abeunte, stigmatibus exsertis; capsula ovato-oblonga sursum triangulari rostrata rufo- vel virescenti-fusca lucida semitriloculari sepala vix excedente; seminibus majusculis ovato-oblongis costato-lineolatis longe caudatis.

Thus far only in New Jersey, where it was found many years ago, at Quakerbridge, *Pickering* in Hb. Ac. Philad., *Durand;* re-discovered within the last few years "in a sphagnous swamp at Griffith's, $6\frac{1}{2}$ miles south-east of Philadelphia,

where it grows with several forms of *J. Canadensis*," *C. E. Smith*, Hb. n. 91; also at Quakerbridge, *C. F. Parker;* flowering in August and in fruit in September.—An interesting and well characterized species closely allied with the last ones, with which it has in common the longer inner sepals and the tailed seeds, distinguished from them by its rough stem and leaves, its large flowers with 6 large stamens, and its large dark seeds with (usually) purplish tails.—Roughness is a rare character in the genus *Juncus*, which I find noticed only in the South American *J. rudis*, Kunth, and the Portuguese *J. rugosus*, Steud.; in these the flowers are smooth just as in our species, while in *J. falcatus* the stem and leaves are smooth and only the flowers rough (see p. 452). All parts of this plant are very rigid, the stems $1\frac{3}{4}$–$2\frac{1}{2}$ feet high, the panicle 2 or 3–6 or 7 inches long, less in expansion; fruit-heads 4–6 lines in diameter, usually with 3–5, sometimes only with 2 flowers; flowers $2\frac{1}{2}$ lines long or more; capsule equaling or scarcely exceeding the rigid and sharp pointed green or darkish tipped sepals; outer sepals indistinctly 5-nerved, inner ones (at least in the dry state) strongly 7-nerved; capsule tough and hard, reddish or greenish brown, at base completely, upwards partially, 3-celled; seeds 0.5–0.6 line long, their diameter being nearly equal to half their length, the lower appendage thick and usually short, the upper one not quite as long as the seed itself; whole seed, with the tail, about $1\frac{1}{4}$ lines long; side of seed with 12 or 14 ribs, and usually distinctly cross-lineolate.

47. J. Mertensianus, Bong. Veg. Sitcha in Mem. Ac. St. Petersb., ser. 6, vol. 2 (1833), 167, ex Kunth, l. c. 361: caulibus e rhizomate crasso repente cæspitosis humilioribus (spithameis pedalibus) compressis debilibus; vaginis foliorum averse compressorum auriculatis; floribus pluribus (15–25) fusco-atris pedicellatis in capitulum laxius singulum seu rarius bina ternave aggregatis spatha brevioribus; sepalis ovato-lanceolatis, exterioribus acuminato-subulatis, interioribus plerumque paulo brevioribus obtusis mucronatis seu rarius exteriora æquantibus acutis, stamina (3–) 6 superantibus capsulam late obovatam obtusam mucronatam æquantibus seu superantibus; antheris oblongis seu oblongo-linearibus sæpissime mucronatis filamentum æquantibus seu eo brevioribus; stylo quam ovarium obtusum plerumque breviore; seminibus oblanceolato-obovatis fusiformibus utrumque breviter caudatis reticulato-costatis, arcis lineolatis.—*J. ensifolius*, Hook. Fl. Bor. Am. 2, 191; Gray in Pl. Hall & Harb. l. c.

Var. β. *paniculatus:* caule elatiore (ultra bipedali); vaginis vix auriculatis; capitulis (6–9) minoribus (10–15-floris) in paniculam compositam dispositis.

From the islands of the North-west coast, Sitcha, *Mer-*

tens, Unalaschka, *Chamisso*, to the Cascade Mountains, *Lyall*, and Rocky Mountains, *Drummond*, Big Horn Mountains, *Hayden*, Medicine Bow Mountains, *H. Engelmann*, and southward to Colorado, *Hall & Harbour*, 565, Huerfano Valley, *C. C. Parry*, and to the Californian Sierras, *H. Bolander*, at the Mono Pass, Hb. n. 92; var. β in the northern Rocky Mountains, *Bourgeau*.

With some hesitation I refer the Rocky Mountain plant, of which I have numerous and well preserved specimens before me, to *J. Mertensianus* of the North-west coast, the authentic specimens of which, at my disposal, are rather incomplete; but they are distinct enough to prove Meyer wrong in referring the Sitcha plant to his *J. falcatus* (Ledeb. Fl. Ross. 4, 228). Bongard, to be sure, describes the leaves as flat, but they are not adverse like those of *J. falcatus*, but averse like those of *J. xiphioides*, and, besides, are slightly but distinctly knotted.

Stems 7–14 inches high, compressed, but not ancipitous except in var. β, "weak and flaccid" (Hall), grooved below, smooth upwards; leaves, as in all its allies, of very different width, usually $\frac{1}{2}$–1 or rarely $1\frac{1}{2}$, but in β $1\frac{1}{2}$–$2\frac{1}{2}$ lines wide; heads $4\frac{1}{2}$–6 lines in diameter; flowers very distinctly pedicelled, $1\frac{1}{2}$ to (commonly) 2 lines long; inner sepals, as in this whole section, quite variable, obtuse to acute and even acuminate, usually shorter, but in some flowers of the Sitcha specimens even longer than the outer ones. Stamens $\frac{2}{3}$ or $\frac{3}{4}$ the length of the sepals, usually 6, but sometimes 3 (3, Bongard; 4–5, Kunth) in Sitcha and Cascade Mountain specimens, 6 in all those from the Rocky Mountains or California, which I have examined; anthers as long as, or, usually, shorter than the filament, often apiculate. Ovary as well as capsule broadly obovate and obtuse. The seeds make a near approach to those of the last section, their appendages being sometimes quite conspicuous; in Hall's Colorado specimens I find them usually very short, while in a specimen of Dr. Hayden's they are almost equal to the diameter of the seed; the seed itself is 0.23–0.30 line long, the length being equal to 2–$2\frac{1}{2}$ diameters; with the appendages they are 0.30–0.35, and in the abovementioned specimen of Dr. Hayden even 0.50 line long; 7–9 and in some Rocky Mountain specimens (*Drummond*, *Hall*) 9–12 ribs are visible on the side; the surface is regularly reticulated with more or less distinct cross-lineolation.

Var. β, with its tall stem, long and broad leaves, and a panicle of 3 inches in length, looks quite distinct from the ordinary form, but I cannot find any more essential differences.

This species with the four following ones, the Mexican *J. brevifolius*, Liebm., and the Asiatic *J. Leschenaultii*, Gay, form a very natural group, united by characters as well as

geographical range. Their compressed or ancipitous stems usually come from a creeping rhizoma, and bear laterally compressed, or averse, equitant leaves, which in the larger forms resemble greatly those of *Sisyrinchium* and other iridaceous plants, and which are very imperfectly septate or articulate; their sheath sometimes terminates with two auriculæ or stipular appendages, or frequently, and in the same species, imperceptibly runs out into the edge of the leaf. The flowers, always pedicelled, are brown, mostly deep chestnut, rarely greenish or paler, and are arranged in few or many-flowered heads; in many species we find forms with single or few large heads in clusters, and others with numerous small heads disposed in compound panicles. The sepals are mostly broad, the outer ones acute or acuminate, the inner ones often shorter and obtuse, rarely longer, often variable even in flowers of the same head. The number of stamens also varies in the same species. The style is distinct, either short, or sometimes very long. The mucronate capsule is about as long or rarely longer than the calyx, nearly one-celled. Seeds reticulate, with smoothish or lineolate areæ. They inhabit the western slope of North America and extend to the Asiatic side of the Pacific.

48. J. XIPHIOIDES, E. Meyer, Syn. Junc. 50 et Rel. Haenk. 1, 143; Kunth, l. c. 331: caulibus (1–4-pedalibus) e rhizomate crasso repente erectis ancipitibus; capitulis pauci- vel multifloris paucis plurimisve; floribus pedicellatis; sepalis lanceolatis subulato-acuminatis æqualibus seu interioribus obtusioribus brevioribus stamina 6 seu raro (in var. ε) 3 fere duplo superantibus capsulam prismaticam acutam mucronatam hinc rostratam plerumque æquantibus; antheris oblongo-linearibus filamentum fere æquantibus; ovario ovato in stylum breviorem attenuato, stigmatibus subexsertis; seminibus ovato-oblanceolatis utrumque apiculatis lineolato-reticulatis.

Var. *a. littoralis:* caulibus robustis elatis (2–4-pedalibus); foliis latis iridaceis, vaginis sæpius inappendiculatis; paniculæ sæpe supradecompositæ capitulis pauci- vel pluri-(3–20)floris e stramineo fuscis; sepalis subæquilongis capsula acuta seu rostrata vix brevioribus; antheris sæpe apiculatis filamento paulo longioribus; seminibus oblanceolatis.—*J. xiphioides*, Mey. l. c.

Var. β. *auratus:* caulibus gracilibus elatis (3-pedalibus ultra); vaginis in folia latiora sensim excurrentibus; paniculæ supradecompositæ capitulis pauci-(5–10)floris stramineis nitentibus; sepalis æquilongis capsula rostrata brevioribus; seminibus ut supra.

Var. γ. *montanus:* caulibus humilioribus (spithameis sesquipedalibus); foliis angustioribus basi plerumque auriculatis; capitulis pauci-(3–10)floris pallidioribus pluribus paniculatis

seu paucis (raro singulis) pluri-(12–20) vel multi-(20–50) floris fuscis; floribus paulo minoribus; sepalis interioribus brevioribus plerumque acutis, exterioribus capsulam longe mucronatam æquantibus; seminibus ut supra.—*J. xiphioides*, Torr. Bot. Mex. Bound. 222; Gray, Pl. Hall & Harb. l. c.

Var. δ. *macranthus:* caulibus mediis (sesqui-bipedalibus); vaginis in folia angustiora sensim excurrentibus; capitulis paucis multi-(18–40)floris; floribus majoribus fuscis; sepalis fere æquilongis, interioribus sæpe obtusiusculis capsulam acutam æquantibus; seminibus majoribus obovatis abrupte apiculatis.—*J. polycephalus*, *a.* ex parte, Hook. Fl. B. Am. l. c.

Var. ε. *triandrus:* caulibus humilibus seu mediis (spithameis bipedalibus); vaginis in folia angustiora sensim excurrentibus; capitulis singulis paucisve multi-(15–30)floris seu pluribus pauci-(5–8)floris paniculatis; floribus majoribus atro-fuscis 3-andris; sepalis æquilongis seu interioribus obtusioribus subbrevioribus capsulam mucronatam æquantibus seu ea brevioribus; seminibus fere ut in var. *a.*—*J. ensifolius*, Wickstr. in Act. Holm. 1823, II. 1; Kunth, l. c. 337.

On the Pacific slope of the continent from southern California to Unalaschka, extending eastward into the plains east of the Rocky Mountains. Var. *a* seems peculiar to the fertile lands of the California coast region: Monterey, *Haenke*, San Francisco, *Bolander*, *Kellogg*, Hb. n. 93, Fort Tejon, *Xantus*. Var. β has been found on Monte Diablo, near San Francisco, *Brewer*, Calif. St. Surv. 338. Var. γ, the large-headed form in the Rocky Mountains, from Oregon, *Spalding*, *Lyall*, to Colorado, *Hall & Harb.* 564, and N. Mexico, *Fendler*, 858, *Wright*, 1925, and into the plains, Saskatchawan, *Drummond*, and Ft. Riley, *H. Engelmann;* the small-headed form is of more southern origin—Arizona, *Coues & Palmer*, 70, N. Mexico, *Wright*, 1923 in part, and west Texas, *Lincecum*. Var. δ only in Unalaschka, *Eschscholtz*, on the "North-west coast," *Douglas*, and in the Cascade Mountains, *Lyall* Var. ε from Unalaschka, *Eschsholtz*, *Chamisso*, *Mertens*, to the Cascade Mountains, *Lyall*, and the Californian Mountains, *Bolander*, Hb. n. 94; the panicled form, San Francisco, *Bolander*.

This species, the type of the group of *Ensifolii*, is as variable as any of its eastern congeners, and its extreme forms are as widely apart in size of stems and leaves, and of flower-heads, in their inflorescence and even in the number of stamens, and transitions between the different varieties are not wanting; but in flower and fruit they are remarkably uniform. —The flowers are 1½ lines long, rarely a little smaller, and only in var. δ and ε larger; the sepals are narrow, the outer ones always long-pointed, but the inner ones quite variable and often shorter; stamens scarcely more than half as long as sepals; seeds 0.23–0.26 line long and attenuate at least at the lower end, except in var. δ; their length is usually equal to

2½ diameters; about 8 ribs are visible on the side; the network of the surface and the cross-lines of the areæ are very delicate but quite distinct.

Var. *a* is often 4 feet high, with a stem 3 lines wide, and leaves 3 or 4 or sometimes even 6 lines broad; panicle 4–8 inches long; heads in some forms, and also in the original Haenkean specimen, few-flowered, in others many-flowered; seeds usually slender and almost fusiform. Var. β, similar to the last, with leaves 2–3 lines wide, is distinguished by its showy, glistening, golden-straw-colored panicles, about 4 inches in length; sepals almost nerveless; capsules larger than in the other forms and longer than the sepals, thus approaching the following species. Var. γ, the mountain and eastern form of the species, is smaller, with fewer heads, either few-flowered and in a small panicle (about 1½ or 2 inches long), or many-flowered, 3–4 lines in diameter and 1–5 or 8 in number; leaves usually ½ to 1½ lines wide. Var. δ may be considered a large flowered north-western form of the latter; flowers 1¾ lines or more in length; seeds 0.25–0.26 line long, thicker than in the other forms and with short and abrupt points. Var. ε, with its very flat and somewhat curved, sword-shaped leaves, and, usually, few large dark-colored heads of triandrous flowers, looks quite peculiar, but flower, fruit and seed are the same as in the other forms. I find plants of the same habit and with the same kind of leaves and heads among the different forms of *J. Mertensianus* and of *J. phæocephalus*, but the fruit and flowers will always distinguish them. The seeds in this variety are intermediate between those of the last and those of the other forms.—Meyer (Linn. 3, 373) describes *J. ensifolius* with an obovate obtuse capsule; I do not find it so, but suppose he had a specimen of *J. Mertensianus* in view, for which this shape of the capsule is quite characteristic.

49. J. OXYMERIS, n. sp.: caulibus (2–3-pedalibus) e rhizomate repente erectis seu ascendentibus compressis; foliis a latere compressis plus minus distincte nodosis; panicula supradecomposita patula seu stricta; capitulis pauci-(5–10)floris pallidis; floribus pedicellatis; sepalis lineari-lanceolatis acuminato-aristatis, interioribus sæpe paulo longioribus stamina 6 quarta parte superantibus capsula lanceolata rostrata unilocularі plerumque brevioribus; antheris longo-linearibus filamento duplo longioribus; stigmatibus ovarium lanceolatum apice attenuatum cum stylo ei æquilongo æquantibus exsertis; seminibus ovato-oblanceolatis apiculatis areis lævibus reticulatis.—*J. acutiflorus*, *floribus solito longioribus*, Benth. Pl. Hartw. 341.

Sacramento Valley, Cal., *Hartweg*, 2017, San Francisco and Mariposa, Cal., *Bolander*, Hb. n. 95.

This species is intermediate between *J. xiphioides*, var. *auratus*, the paniculate form of *J. phæocephalus* and *J. dubius;* from the two first it is distinguished by the sharp pointed sepals and their proportion, and the almost subulate capsule, which is similar to that of *J. nodosus*, from the first also by the long anthers, from the last by the flat leaves, and from both these by the sculpture of the seed. Sheaths of the leaves with or without auricular appendages, leaves 1–2½ lines wide; panicle 4–6 inches long; flowers 1¾–2 lines long, greenish straw-colored or sometimes reddish towards the tip; seeds 0.22–0.24 line long, with the ribs (7–9 visible on the side) slightly crenulate but the areæ smooth.

50. J. PHÆOCEPHALUS, n. sp.: caulibus erectis compressis apice capitulum singulum paucave multiflora seu rarissime plura minora paniculata gerentibus; foliis compressis basi auriculatis seu inappendiculatis; floribus majoribus fusco-atris pedicellatis; sepalis lanceolato-ovatis æquilongis omnibus acuminatis acutis vel cuspidatis seu interioribus obtusatis stamina 6 paulo superantibus capsulam obtusam seu acutam mucronatam subunilocularem æquantibus seu ea paulo brevioribus; antheris late linearibus filamento bis terve longioribus; ovario lanceolato in stylum æquilongum attenuato, stigmatibus elongatis exsertis; seminibus ovatis utrumque apiculatis areis sublævibus reticulatis.—*J. Rostkovii?* Meyer in Rel. Haenk. 1, 142.

Var. *α. glomeratus:* rhizomate longe repente, caule spithameo sesquipedali; vaginis sine auriculis in folia latiora sensim excurrentibus; capitulis multi-(15–25)floris paucis glomeratis.

Var. *β. paniculatus:* caule bi-tripedali; vaginis foliisque ut in *α*; capitulis minoribus pauci-(8–12)floris composite paniculatis.

Var. *γ. gracilis:* cæspitosus caule digitali spithameo; vaginis auriculatis; foliis angustis seu angustissimis; capitulis multi-(15–20)floris sæpius singulis.

California, from the sea-coast into the Sierras; var. *α* near the coast, from Monterey, *Haenke*, *Brewer*, to San Francisco, *Bolander*, *Kellogg*, Hb. n. 96, and to Mendocino, *Bolander;* var. *β* also in the lowlands, Napa Valley, *Bigelow*, San Francisco, *Bolander*, *Kellogg*, Hb. n. 97, and in the mountains, *Bolander;* var. *γ* in the higher mountains, about the "Big Tree Grove," *Hillebrand*, *Bolander*, and especially in the upper Tuolumne Valley, *Brewer*, Cal. St. Surv. 2339, 1709 & 1760, *Bolander*, 5062, Hb. n. 98, and Mono Pass, *the same*, 6013. — All the forms of this variable species are readily recognized by their deep brown heads, large flowers, broad sepals, large conspicuous anthers, long style, and by the markings of their seeds, whatever the height of the stem, width of

the leaves or nature of the inflorescence may be.—Flowers 2–2½ lines long; sepals broad and either obtuse, or, usually, acute or acuminate and even with subulate tips, the inner ones as long as the outer ones, but often more obtusish; anthers about 1 line (in a large-flowered specimen of var. γ even 1½ lines) long, always much longer than the filament; capsule long mucronate, scarcely exceeding the sepals, incompletely 3-celled, by the projection of the placentæ; seeds 0.31–0.33 line long, their length being equal to 2 diameters; 8 or 9 ribs visible; reticulation close but distinct; areæ smooth or marked with one or two delicate perpendicular lines, and thus similar to the seeds of *J. scirpoides*, which, however, have fewer ribs.—E. Meyer (l. c.) describes the plant very correctly, but suspecting that the flattened appearance of stem and leaves might be owing to undue pressure in drying, places it with doubt with *J. Rostkovii*, from which it is widely different.

Var. α has leaves 1–2 lines wide, as long or longer than the stem; heads large, about 5 lines in diameter, usually 2 or 3 in a cluster, or sometimes as many as 6 or 8 in a short panicle.—Leaves of var. β 2 lines wide, shorter than the tall stem; panicle loose-flowered, somewhat erect, sometimes 6 inches in length. Some of the mountain forms collected by Mr. Bolander (Yosemite Valley, Cal. St. Surv. 6036, and especially "alpine meadows," 6006, which is only a foot high) have smaller flowers 1½–1¾ lines long, and seem to approach closely to *J. oxymeris*.—Under Hb. n. 97 two forms have been inadvertently mixed, one the real var. *paniculatus*, and the other a tall (2–3 feet high) several-headed form of var. *glomeratus*. —Var. γ is a small mountain form, which with its dark heads, large flowers, and long protruding stigmas, resembles so nearly the smaller forms of *J. falcatus*, that a close examination only will distinguish them; leaves ¼–½ line wide; heads 4–5 lines in diameter, single or two together.

51. J. CHLOROCEPHALUS, n. sp.: caulibus (pedalibus sesquipedalibus) e rhizomate brevi repente cæspitosis erectis et foliis compressis; capitulis multi-(15–25)floris singulis seu paucis glomeratis spatham membranaceam subæquantibus; floribus magnis conspicue pedicellatis pallidis; sepalis oblongis obtusis seu exterioribus et rarissime interioribus mucronatis æqualibus seu interioribus paulo longioribus stamina vix excedentibus; antheris longe-linearibus filamento multo longioribus; stylo ovario ovato pluries longiore exserto; stigmata æquante vel iis longiore; capsula ovata obtusa mucronata uniloculari sepalis breviore; seminibus ovatis utrumque apiculatis reticulatis.

In the higher mountains of California, *Hillebrand*, Cal. St. Surv. 2338; dry places on peaks near Mount Dana, 10,000 ft. high, *Brewer*, Cal. St. Surv. 1804; along the rapid current

of streamlets in Yosemite Valley, 4,000 feet high, *Bolander*, Cal. St. Surv. 6033, Hb. n. 99; mountains near Carson City, Nevada, *C. L. Anderson.*— Allied to the last, but readily distinguished by its pale flower heads, which look more like those of some cyperaceous plant, its broad and obtuse sepals, small ovary, very long style, shorter stigmata, and very short obtuse capsule.—The specimens before me are from 10 to 17 inches high, pale green, with the auriculate sheaths often rose purple; leaves ½–1 line wide, like the stem compressed, but not ancipitous, shorter than the stem; 1–3 heads, 6–7 lines in diameter; flowers 2½ lines long, pale or whitish-green, shining; sepals very obtuse, often mucronate or cuspidate, with broad membranaceous margins; stamens scarcely shorter, and sometimes even a little longer, than sepals; anthers twice to four times as long as filament, much exceeding the ovary; style often twice as long as the ovary; capsule, in the only fruiting specimen which I could examine, much shorter than the sepals; seeds (immature) very similar to those of the last species, 0.32 line long and more than half as wide, 7–8 ribs visible on the side, reticulation distinct, but, as yet at least, no transverse lineolation visible.

During the two years which have passed since the first part of this paper, pp. 424–458, was published, the attention of many botanical friends has been directed to our *Junci*, and their exertions have enabled me to add several new species to the foregoing list, complete the history of others, and make several additions and corrections. In the foregoing pages I have already acknowledged the liberality of Professors Roeper and Decaisne, who have enabled me to study the *Junci* of Lamarck and of Michaux; I have now also seen fragments of those collected by Haenke on our western coast from the Herbarium of Prague sent by Professors Kosteletzky and Von Leonhardi, and those obtained on the north-west coast by the Russian explorers, communicated by Director Regel of St. Petersburg. Thus, I believe, I have had an opportunity of examining all the original specimens of the older authors; the single *J. Pylæi*, La Harpe, from the "little island of Saint-Pierre-de-Miquelon, near Newfoundland," remains unknown to me.

The request for assistance in forming an *Herbarium Juncorum Boreali-Americanorum Normale* (p. 424) has been generously responded to by twenty-three botanists, who have sent sets of 99 plants, to be distributed by me among the great standard herbaria of this country and of Europe and among the contributing botanists themselves. They are quoted in these pages as *Herb. norm.* or *Hb. n.* The largest

number of species were sent by Messrs. Bolander and Kellogg of California, Ravenel of South Carolina, and Bigelow of Michigan, and after them by Messrs. Porter and Smith of Pennsylvania and Chapman of Florida. My own and the whole botanical fraternity's acknowledgments are due to all of them.

The 99 numbers comprise 38 different species — among them 10 described here for the first time and 12 very rare or critical ones—and 20 important varieties; the balance consist of minor varieties, different forms of the same species or variety, and in a few instances the same plant from different localities. The specimens are not all of equal value or beauty, in some few instances they are inferior, or the different specimens of the same number are sometimes not sufficiently homogeneous for a collection that claims to be a standard one; but on the whole they will be found satisfactory, and many of them very perfect and better and more complete than they can be found in most herbaria. If my friends or the friends of botany in this country will undertake the labor of collecting and sending me specimens of the *Junci* not at all or only incompletely represented in the Herbarium Normale, I will cheerfully promise to do my best to arrange and distribute them in the same manner as in the present collection. I would, in this case, urge the importance of getting not only those species that are wanting in the Herb. Norm., but especially the intermediate and doubtful forms, that connect the different forms of such polymorphous species as *J. scirpoides* or *J. Canadensis* and similar ones.

ADDITIONS AND CORRECTIONS.

Pag. 425. Among the vegetative organs, the *roolstock* (not root-stalk, as misprinted) has been barely mentioned, while it is a most important organ and exhibits many differences in the different species of perennial *Junci*. Very few of our species are annuals, and these all belong to the section *graminifolii: J. bufonius*, *triformis*, *Kelloggii*, and, I believe, *repens*. The others bring forth buds from the axils of the lowest scaly leaves (*Niederblaetter*) at or soon after the period of flowering, and especially at the time the fruit ripens, in the form of short leaf-buds or stolons or horizontal rhizomas, which preserve the existence of the plant through winter while the old stock is decaying, and in the following season produce the new flowering stalks and die themselves in the succeeding summer or fall when their successors are forming, so that the living part of the plant never gets more than a year old; but in most species the rhizoma, often bearing the vestiges of the decayed flowering stems, continues to exist much longer, at-

tached to the living plant, but destitute of vitality. The buds are very short and ascending in the cespitose species, *J. acuminatus*, etc.; in the creeping ones they form shorter or longer stolons, fibrous (*J. falcatus*, *J. phæocephalus*) or fleshy (*J. scirpoides*), and often bearing a bunch of leaves at their end; in *J. nodosus* the stolons form thin fibres, which bear little bulbs, and often a series of them, the source of the stems of next season (see Herb. norm. 74, where in many specimens the old withered stolons with the vestiges of the decayed stems of last season and the new ones can be seen). The species of the first section (*Junci genuini*) have stout horizontal rhizomas, and none stouter than the maritime species (*J. acutus* and *Rœmerianus*), which bear upright stems at almost every node, and not at the end like most *articulati;* where the internodes are short, they become cespitose, where they are long the plants are called creeping; difference in soil and moisture, however, seem considerably to influence the length of the internodes in the same species.

Pag. 427. For "*J. pallescens*," wherever that name is used for one of our species, read *J. acuminatus;* for "var. *fraternus*," var. *legitimus;* for "*J. Buckleyi*," *J. leptocaulis;* and for "*J. saginoides*," *J. triformis*, var. *uniflorus*.

Pag. 428. The "subgenus *Juncellus*" here and p. 436 must be cancelled.

In *J. pelocarpus* and *J. acuminatus* the viviparous buds are the result of retrograde metamorphosis; in other cases they may be produced by insects, and are then much larger degenerations.

Pag. 430. It is evident, that the sculpture of the seeds is the result of the structure of both the epidermis and the next inferior layer of cells, which both together probably constitute the *testa;* in some species it is more one, in others more the other stratum, which gives character to the appearance of the seed. My investigation of these points is not sufficiently advanced to furnish definite results; but I may state, that, what I have, in common with other authors, designated as the *testa*, properly seems to be the epidermis only, consisting of a single layer of cells, always larger than those of the layer under it, and never transverse. In most species the epidermis is thin, transparent, and closely adhering to the body of the seed; in others (*J. Rœmerianus*, *Balticus*, *arcticus*, etc.) it is thicker, swells up when moistened and may then be detached; in others again, those with tailed seeds, it is quite thick and loosely adhering to the body of the seeds, so as almost entirely to obscure their proper sculpture. In the first two classes the cells of the epidermis are about as wide as they are long, and only in part correspond with the sculpture of the seed; they seem, however, to cause the markings designated by me as "levissime irregulariter reticulata" (p. 432,

I. 1). In the third class these cells are narrow and much elongated, sometimes as long as the seed itself, and their thick walls form the ribs of these seeds.

Dr. F. Buchenau, the acute observer of the *Junci*, has published the results of his observations on the seeds of the German species in Botanische Zeitung 25, p. 201 (June 25, 1867). He generally coincides with my views; but a new term for the crossbars of the reticulated seeds, *transtilla*, seems to him necessary, and for my *semina lineolata* he substitutes the words *transverse reticulata*, which is correct in itself and was used by me p. 431 and p. 432, II. 1. but does not seem to me to express the predominant character of these seeds as well as the former term. He also minutely describes the color of the seeds, a character which I have occasionally mentioned, but which seems to be in most species too slight, and even varying, to give it much importance.

Pag. 432. *J. brachycarpus, oxymeris* and *falcatus* ought to be classed under I. 2. For "*J. rudis*" read *J. microcephalus*. *J. dubius* comes under I. 3. *J. acutus* belongs rather between I. 1 and I. 2, and *J. Kelloggii* near *J. marginatus*, III. 1. *J. longistylis* together with *J. obtusatus* may be properly classed under I. 2. The apparent necessity of these numerous changes is a proof of the difficulty of properly classing the seeds; only completely ripe and well developed seeds ought to be used for these investigations.

Pag. 433. It ought to have been stated that in the systematic arrangement all the species not expressly marked as belonging to 3-androus sections, are 6-androus.

Add: 5. b. *J. Lesueurii* for subsp. *Pacificus*.

Pag. 434. 10. *J. Smithii* comes under 1. *Aphylli*.

Pag. 435. 27. *J. repens* was inadvertently classed with the 6-androus species. The *Glomeruliflori* would be better arranged thus:

* Triandri. (No. 26 b. & c. sæpius uniflori; No. 30, 3-6-andrus.)

J. Kelloggii, n. sp. California.
J. triformis, n. sp. California.
J. repens, Michx.
J. marginatus, Rostk.
J. leptocaulis, Torr. & Gr.

** Hexandri.

J. falcatus, Mey.
J. obtusatus, n. sp. California.
J. longistylis, Torr.

The other changes, necessary on this and the following page, the reader will please make for himself, following the text from p. 459 onward.

Pag. 438. *J. acutus*. The specimens said to come from New Jersey are from Z. Collins' herbarium, and are, as Mr.

Durand informs me, undoubtedly of European origin; the only certain locality in North America is the Californian one.

Pag. 439. *J. Rœmerianus.* The New Jersey locality rests on the doubtful authority of Pursh; I have seen no specimens collected farther north than Wilmington, N. Carolina, whence Mr. Canby has sent it, Hb. norm. 1.

Pag. 441. *J. Balticus* has been distributed in Hb. norm. 4 from Pennsylvania, *Porter;* 3, Michigan, *Bigelow;* 2, Wisconsin, *Lapham*, and 5, Californian Mountains, *Bolander.* It also occurs on the Pacific coast at least as far south as the Dalles of the Columbia, *Lyall; J. Haenkei*, Mey. Junc. p. 10, is a depauperate northern form.

Pag. 442. In place of "subsp. *J. Pacificus*," put:

5. b. J. Lesueurii, Bolander, in Proc. Acad. Cal. 2, 179 (1863): rhizomate repente; caulibus (2-3-pedalibus) crassioribus mollibus sæpe fistulosis; paniculæ ramis secundis; floribus (bruneo-striatis) majoribus; sepalis lanceolatis exterioribus acutissimis interiora obtusa paulo superantibus, omnibus supra capsulam ovatam vix obtuse angulatam acutam breviorem vel æquilongam conniventibus; antheris 6 late linearibus filamento brevissimo quadruplo quintuplo longioribus; seminibus magnis ovatis obtusis breviter vel vix apiculatis tenuissime irregulariter reticulatis vel lævisculis.—*J. Balticus*, Benth. Pl. Hartw. 341; *J. Balticus*, subsp. *Pacificus*, p. 442; *J. compressus*, E. Mey. Pl. Cham. in Linn. 3, 368, and *J. pictus*, Philippi, ib. 33 (1864), p. 268 (planta Chilensis).

In saltmarshes and in saline sandy soil near the coast of San Francisco bay, *Bolander*, *Kellogg*, Hb. n. 6.—Fl. July and August.—The plant certainly stands close to *J. Balticus*, but may always be recognized by the characters given above, and the habit is quite different. The stems of the larger specimens are much thicker, often 2½–3 lines in diameter, and softer; inflorescence as in all its allies very changeable, sometimes loose but more commonly compact and with strikingly 1-sided branches; flowers larger than in *J. Balticus*, 2½–3 lines long, and capsule from an oval base pointed; seeds 0.30–0.37 and in Chamisso's Chilian specimen even 0.40 line long, smoothish or usually somewhat reticulate, the network corresponding with the cells of the epidermis, which when removed leaves the seed, very similar to that of *J. Balticus*, marked with a distinct but delicate transverse reticulation; something of this is also seen on the inside of the detached epidermis, perhaps from adhering parts of the second layer of cells. *J. Balticus* has usually smaller flowers, 1¾–2 lines long, only in north Pacific specimens have I seen them nearly as large as in *J. Lesueurii;* its capsule is more prismatic and abruptly mucronate, the seeds of the same size, but, evidently owing to the greater transparency of the epidermis,

which otherwise exhibits the same structure, always marked with regular transverse reticulation.

Pag. 443. *J. effusus.* Several forms are distributed in Herb. norm.; the common one from Michigan, 7, and South Carolina, 8, and an unusually slender one, 9, from the Californian mountains, where the common one also grows. The western botanists find in the saltmarshes near San Francisco a brown flowered variety, which may be distinguished as var. *bruneus;* inflorescence somewhat looser and fastigiate, Herb. n. 10, or more compact, ib. 11; other differences, if they exist, have escaped me.

J. patens was distributed by Dr. Kellogg in Herb. norm. in two forms; 12 is a tall plant with loose panicles of green flowers, 13 a low (8–15 inches high) rigid form with a more compact darker colored inflorescence.

Pag. 444. J. Smithii: rhizomate longe repente; caulibus ($1\frac{1}{2}$–2-pedalibus) gracilibus teretibus farctis siccis striulatis basi vaginis fusco-rufis breviter aristatis instructis; paniculæ laxæ vix compositæ paucifloræ spatha longissima; sepalis æquilongis, exterioribus lanceolatis acutatis, interioribus obtusis stamina 6 fere duplo superantibus; antheris oblongis filamentum æquantibus; ovario ovato in stylum brevem attenuato cum stigmatibus eo æquilongis fere incluso; cetera vide p. 444.

Found abundantly by Messrs. Smith, Porter and Leidy on Broadmountain, Pennsylvania (Herb. norm. 15), where it had been discovered by the former the year before; also in Rausch's Gap, Lebanon county.—The very complete specimens sent by these gentlemen enable me to complete the history of this, thus far, very rare plant, which proves to be intermediate befween *J. Balticus* and *J. filiformis*, with the rootstock of the former and the inflorescence of the latter, and with almost the seeds of *J. arcticus*. Seeds 0.32–0.38 line long, with short and broad appendages and a distinct rhaphe, distinctly but somewhat irregularly reticulate and partly also lineolate; epidermis easily removed after soaking.

J. setaceus; a larger and a smaller form from South Carolina have been distributed in Herb. norm. 14 by Mr. Ravenel; internodes of the creeping rhizom short, stems cespitose.

Pag. 445. *J. arcticus* is more closely allied with *J. Balticus* and *Smithii* than with *J. Drummondii;* more specimens obtained from the coasts of the north Pacific show that the var. *Sitchensis* is not rare there, and extends to Kamschatka; its characters hold their own well.

J. Drummondii, Californian Alps, *Bolander*, Hb. norm. 16.

Pag. 446. *J. Parryi;* a form with the interior sepals obtuse and much shorter than the exterior ones, which are as long as the capsule, was found by Mr. Bolander on alpine meadows, California.

Pag. 448. *J. stygius* also on the north shore of Lake Superior, *O. B. Wheeler;* it seems rare everywhere, so that I have not yet been able to obtain it in sufficient quantity for the Herb. norm.

J. Vaseyi; while I was deploring the destruction of Dr. Vasey's original locality, Rev. Mr. Holzer and Dr. Bigelow discovered this species in abundance in damp open woods on both sides of the river near Detroit, growing together with *J. Greenii.* Dr. Bigelow's fine specimens are distributed in Herb. norm. 17. Many of them are $2\frac{1}{2}$ feet high.

Pag. 449. *J. Greenii;* Dr. Bigelow's Detroit specimens, Hb. n. 19, are 2–$2\frac{1}{2}$ feet high, taller and stouter than those found on the coast, Massachusetts, *H. Mann*, Hb. n. 18, Maine, *E. Tuckerman.*—Both species hold their own perfectly well, and can always be readily distinguished by the characters given above; *J. Vaseyi* is also a much more slender plant and flowers earlier, maturing its fruit, near Detroit, in the beginning of July, when the other is just in flower.

Pag. 450. *J. tenuis;* a form with long spathes, most specimens tall, is Hb. n. 20 from Pennsylvania, *Porter;* another, even taller, with the flowers often one-sided, is 21, from Illinois, *Hall;* 22 is the var. *congestus*, from California, *Kellogg*, unfortunately in too few specimens; 23 is var. *secundus*, from Pennsylvania, *Porter.*

J. dichotomus has been found as far north as Delaware and New Jersey, *Leidy, Commons, Parker*, Hb. n. 24, and others. Mr. Ravenel sends from South Carolina a taller form, Hb. n. 25, and a smaller, few-flowered one, 26.

Pag. 451. *J. Gerardi*, Massachusetts, *Mann*, Hb. n. 27.

J. bufonius, Hb. n. 28, is an erect form from the coast region of California, *Bolander.*—Prof. E. Hilgard found on the sandy beach of Ship Island in the Mississippi Sound the var. *fasciculiflorus* with perfectly smooth seeds; specimens of the same sent by Lindheimer from Galveston show extremely slight marks.

26. b. J. TRIFORMIS, n. sp.: caule annuo brevissimo folioso ramuloso; pedunculis capillaribus scapiformibus numerosis ($\frac{1}{2}$–4 pollicaribus) folia brevia filiformia supra canaliculata apicem versus plana longe excedentibus; floribus paucis capitellatis vel singulis; sepalis lanceolato-subulatis æquilongis capsulam ovatam obtusam mucronatam 2–3 locularem fere æquantibus; seminibus ovatis obtusis breviter apiculatis tenuiter pauci-costatis et transverse lineolatis.

Var. *α. stylosus:* planta major (2–4-pollicaris); capitulis 3–5-floris; sepalis stamina et capsulam longius mucronatam paulo excedentibus; antheris longe-linearibus filamento plus quam duplo longioribus; stylo ovario ovato pluries longiore exserto, stigmatibus elongatis.

Var. *β. brachystylus:* planta minor (1–2-pollicaris); flori-

bus binis ternis rarius singulis; sepalis stamina fere duplo superantibus; antheris oblongis filamento bis brevioribus; stylo brevissimo cum stigmatibus brevibus incluso; capsula calycem æquante vel vix excedente obtusa brevissime mucronulata.

Var. γ. *uniflorus:* planta minima (½–1-pollicaris); floribus bracteis 2 suffultis singulis plerumque 2-meribus (sepalis 4, staminibus stigmatibus carpellisque binis). — *J. saginoides*, p. 436.

California, from the coast to the mountains; var. α. Yosemite Valley, alt. 4,000 feet, *Bolander*, Hb. n. 30; fl. July; var. β. Ukiah, Mendocino county, *the same*, Hb. n. 31, fl. May, also "Fort Bragg, near the coast" (1–3-flowered); var. γ. Sierra Nevada, among mosses, *Hillebrand;* upper Tuolumne River, *Bolander*, and in the lowlands, Anderson Valley, *the same*, Hb. n. 32; fl. April and May.

A curious and suggestive little plant, which must considerably undermine our confidence in certain characters, considered of specific value, already shaken by the variations of other species from the same wonderful country; it proves that the singleness or plurality of flowers on the peduncle, the number of their parts, and, if my view is correct, even the proportion of stamens and styles, are not sufficient to establish specific distinction. The first points are established beyond a doubt by some of Mr. Bolander's specimens from the mountain region, intermediate between β and γ with one or two flowers, and often with a dimerous and trimerous one in the same inflorescence. Var. α may be considered a distinct species by those that hold its differential characters to be of paramount importance, but the similarity of the whole appearance of the plants and of most of their parts, and, above all, the absolute identity of the well-marked seeds, convince me that it must be united with the others, and that eventually intermediate forms will dispel all doubts.

Only the small dimerous form was known to me when the first part of this paper went to press, and was then considered as the type of a distinct subgenus, *Juncellus*, allied through its single-flowered stems to *Rostkovia*, and distinguished by its dimerism from any other known *Juncus* (see pp. 426, 428 & 436). Mr. Bolander, however, has since discovered other forms of this plant which bear trimerous flowers, thus assimilating it to the ordinary form of *Junci* and more particularly to the European *J. capitatus*, and destroying the subgenus *Juncellus*. I am now convinced that it must be placed with its European ally near *J. marginatus*, in the section *Gramineі*, the dimerous variety constituting an anomaly not otherwise observed in this genus, but again found among the allied *Restiaceæ* and *Eriocauloneæ*, where dimerism and

trimerism occur in the same genus—whether in the same species, is unknown to me.

In all the forms of this little plant the leaves are 2–12 lines long and ¼ line wide, filiform, but fleshy, on their lower part strongly carinate below and grooved above, flattened towards the tip; axillary stems, or properly peduncles, with one or two leaves at their base, naked upwards and much longer than the leaves, bearing at the apex 1–5 or 6 flowers in the axils of membranaeeous bracts, half as long as the sepals or smaller; flowers 1–1¾ lines long; sepals green with red, outer ones sharp pointed, inner ones rather broader; seeds 0.23–0.28 line long, their length being equal to 1½ or 1¾ diameters; 4 or 5 faint ribs visible and between them a well marked cross-lineolation. The central peduncle is really terminal and bears the earliest flowers, the lowest axillary one is the next in the progress of development, and then follow the others in ascending order, so that the one next to the terminal one bears the latest flowers; in the smaller specimens the leaves of the main stem and, consequently, the peduncles are alternating, or in ½ order.

Var. *α* is the largest one with a remarkably long style, about 3 times as long as the ovary, and much exceeding the sepals and the very long anthers; its seeds, however, are among the smallest of the species;—var. *β* is intermediate in size between both others; when the heads bear 2 flowers, these are arranged exactly like those of *J. pelocarpus*, with 2 lower bracts, bearing the flowers in their axils, and a third sterile one at the inner base of the upper flower; sometimes this upper flower is dimerous;—var. *γ* is the smallest one only ½–1 inch high; its single flowers have 2 bracts at their base, just as those of any other single flowered *Juncus*, and alternating with the exterior sepals, the stamens, carpels and stigmas; the inner sepals and the valves of the capsule are opposed to them.

26. c. *J. Kelloggii*, n. sp.: caule annuo folioso brevissimo ramosissimo; foliis e basi vaginali latiore filiformibus supra canaliculatis; ramulis abbreviatis infra foliosis capitula laxa pauci- (3–5)flora terminalia et subinde ex axillis inferioribus pedunculos longiores bifloros gerentibus; sepalis lanceolato-subulatis æqualibus medio herbaceis stamina 3 tertia parte superantibus capsulam ovatam obtusam mucronatam tenui-membranaceam 3-locularem fere æquantibus; antheris oblongo-linearibus filamento brevioribus; seminibus ovatis vix apiculatis pauci-costatis lineolatis.

Sandy soil in San Francisco, in flower and fruit in April, *Dr. Albert Kellogg*, for whom as the pioneer of modern Californian botany, which he investigated and elucidated, at first unaided and struggling with numerous impediments, this

plant has been named.—Nearly allied to the last but differing in many striking points, this little species represents a glomerule of a few lines in diameter, pushing out in all directions a number of thread-like leaves; these are 6–10 lines long, and $\frac{1}{4}$–$\frac{1}{2}$ line wide; the short terminal heads are quite loose, the flowers on such distinct peduncles that one would be inclined to consider them as single, if the pair of bracts were not wanting which always surround the base of single flowers in this genus; the lowest axils of a branch often produce longer peduncles, elevated above the glomerate mass, but shorter than the leaves, and bearing small heads, usually of two flowers only. Flowers pale green and whitish, and, especially the capsule, of very delicate structure, $1\frac{3}{4}$–2 lines long; seeds 0.25 line long, $1\frac{1}{2}$ diameters equal to the length, similar to the seeds of the last species, but with much more prominent dark ribs, 4 of which are visible on the side.

Pag. 452. *J. repens*, Hb. n. 29, South Carolina, *Ravenel.*

J. falcatus; add: capsula sepala subæquante; seminibus lanceolato-ovatis epidermide plus minus producta subcaudatis irregulariter costato-reticulatis, areis elongatis lævibus.—Sandy soil near San Francisco, *Kellogg*, *Bolander*, Hb. n. 40.—Ripe seeds 0.35–0.40 line long, length equal to 2 or $2\frac{1}{2}$ diameters; tips slightly or rarely considerably elongated, or the upper one wanting; surface palish and shining, with a thick rather loose epidermis, the cells of which correspond with the reticulation of the seed.—A form from the mouth of the Columbia, *Douglas*, communicated by Dr. Hooker, has an obtuse capsule and thick ovoid seeds.—The differences between this and what I have named *J. Tasmanicus*, p. 453, note, seem to be almost too slight to be of specific value.

Mr. Bolander sends from sphagnous swamps near Mendocino, California, a form which may be distinguished as var. *paniculatus;* analogous to the paniculate forms of *J. phæocephalus* and others; the heads of the simple or somewhat compound panicle are about 5-flowered; Hb. n. 41, not yet in bloom in May; no stipular appendages at the base of the leaves. Maturer specimens would be desirable.

Pag. 453. 28. b. J. OBTUSATUS, n. sp.: rhizomate repente stoloniformi; caulibus (spithameis) erectis lævibus plerumque 1-foliatis folia linearia plana tenuia fere æquantibus; capitulis pauci- seu pluri-floris paucis in paniculam simplicem dispositis; floribus minoribus virescentibus extus leviter scabrellis pedicellatis; sepalis ovatis æqualibus, exterioribus sæpe cuspidatis, interioribus obtusissimis capsula ovata obtusa brevissime mucronulata 3-loculari multo brevioribus; staminibus 6 dimidia sepala superantibus ovarium obtusum cum stylo breviore æquantibus; stigmatibus elongatis exsertis; seminibus ovatis obtusis seu vix apiculatis reticulatis.

Near the Big Tree Grove, Mariposa, California, growing in

large tufts, 2–3 feet in diameter, on the sandy banks of streamlets, alt. 6,500 feet, *H. Bolander*, fl. in July. — In many respects intermediate between the foregoing and the following species, this plant is distinguished from both by its small obtuse flowers, green with light brown margins ($1\frac{1}{2}$, or in fruit nearly 2, lines long), the elongated obtuse capsule, and above all by the distinctly reticulated almost obtuse seeds, which in both others are more or less pointed or even tailed and differently marked; the seeds, I could examine, not quite mature, are 0.25 line long and half as much in diameter, and exhibit 8 ribs on one side; their areæ are apparently smooth.

J. longistylis also on the Red River of the North, *Hubbard* in Hb. Lapham; Huerfano Valley of the Rocky Mountains, *Parry;* on the banks of Mono lake in the Californian mountains, *Bolander*, Hb. n. 43. — Stem with several short leaves, always considerably exceeding the linear foliage; seeds apiculate or short tail-pointed, with a distinct white raphe, strongly ribbed, when not perfectly mature, like those of *J. marginatus;* fully ripe seeds with very slight cross-bars and a faint transverse lineolation.

Var.? *latifolius:* caule erecto (pedali) nudo seu basi unifoliato, folia brevia lineari-lanceolata longe excedente; panicula simplici spatha membranacea rare foliacea longiori; capitulis pauci- (3–5-)floris; antheris longe linearibus filamento triplo quadruplo longioribus; seminibus obovatis costato-subreticulatis.

Californian Sierras on alpine meadows or along rivulets in the Yosemite Valley, alt. 4,000 feet, Hb. n. 46; on the upper Tuolumne, alt. 10,000 feet, and frequent on the eastern slope of the mountains, *H. Bolander.* — Easily recognized by its broad (2–3 lines wide) and short (2–4 rarely 5 inches long) light green leaves, few-flowered heads and long anthers. but probably not specifically distinct; seeds 0.25–0.30 line long, reticulate with faint cross-bars, areæ slightly lineolate or almost smooth; 7 or 8 ribs visible.

Pag. 454. *J. leptocaulis;* the Arkansas specimens have been collected by Dr. Leavenworth; for the Texan localities credit is also due to that ardent old gentleman, Dr. Gideon Lincecum, who, in his 79th year, still continues an active botanist, and is now seeking a new field in Mexico.—Mr. Buckley protests against the change of his and the restoration of an older manuscript name, and threatens to lay the matter before the public for arbitration, in which I wish to assist him, referring only to the remarks on page 454.

J. marginatus; var. *paucicapitatus* ought to follow var. *vulgaris;* both are distinguished from the other variety by a more slender growth, meagre panicle, and mostly smooth edges of the leaves; in Herb. norm. only gracile forms are represented, 33 Pennsylvania, *Porter;* 34 West Canada,

Bigelow; 35 South Carolina, *Ravenel;* var. *biflorus* is a stouter plant with broader leaves, rough on the edges and a larger panicle; Hb. n. 38 Delaware, *Commons;* 39 S. Carolina, *Ravenel.* Intermediate forms do not seem to be rare and are found in Hb. n. 36 and 37. Characters taken from the relative length of the inner and outer sepals, or from the differences in the shape of the capsule, seem to be entirely inconstant. No species bears more abundant seed than this, but in the collections it is rarely found fully mature.

Pag. 455. *J. pelocarpus;* as far west as the banks of the St. Peters river, in Minnesota, *C. C. Parry.*—It seems that the plant attains its normal development, and bears fruit only in a northern climate, and grows then only 4–7 or 8 inches high, Massachusetts, *Tuckerman* in Hb. n. 45, while the proliferous forms usually become 1 or 2 feet high, New Jersey, *Smith & Leidy* in Hb. n. 46; the interesting southern var. *crassicaudex*, Florida, *Chapman*, Hb. n. 47, is often 2 feet or more in height and bears a very large decompound panicle, 5–9 and even 11 inches long.

A specimen of Michaux's *J. fluitans*, from his own herbarium in Paris, bears me fully out in my supposition that it is a depauperate water or mud form of this species; its short, rooting stems, about 4 inches long, bear single terminal 2-flowered heads; the flower I could examine was not fully open yet, and leaves me in doubt whether it is 3- or 6-androus. The description of La Harpe is not quite correct in so far as he attributes to the head 2 external bracts; while they have 3 as the 2-flowered heads of the regular form have, one under each flower, and a third one above the upper flower. Michaux found his plant, as Prof. O. Brunet of Quebec informs me, on the Chicoutimi, about 100 miles north of Quebec.

Pag. 458. *J. articulatus,* as far west as the shores of Lake Erie, *G. W. Clinton;* in Herb. norm. 48 from Western New York, *Sartwell*, and 49 from Massachusetts, *Tuckerman.*—A form with obtuse 5-flowered green heads in a spreading and often almost level-topped panicle, obtuse, mucronate sepals and obtuse short mucronate capsule, which I designate as var. *obtusatus*, has been found by Messrs. *Diffenbaugh* and *Burke* on the river banks near Philadelphia; Hb. n. 50.

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